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MISCELLANEOUS PUBLICATIONS.

Report on the Soils of Kent, Surrey, and Sussex.—This report, which has been prepared by Mr. A. D. Hall, M.A., F.R.S., and Dr. E. J. Russell, of the Rothamsted Experimental Station, contains an account of the soils of the three south-eastern counties, together with a general description of the agriculture of the district.

Analyses of the different varieties of soils are given, and the relation of soils to crops is discussed. The book contains numerous illustrations and a large number of maps showing the distribution of the principal crops.

Copies of the report, bound in cloth covers, may be obtained from the office of the Board, price 2*s.* 6*d.*, post free.

British Breeds of Live Stock.—The object of this handbook is to give an account of the chief characteristics of the principal British breeds of horses, cattle, sheep, pigs, and poultry, with a brief history of their origin, and of some of the principal animals which have formed the foundation stock of the pedigree animals of the present day.

The handbook contains 137 pages of letterpress, and is illustrated by some ninety photographs of animals of the different breeds. It has been published in English, French, German, Spanish and Italian, and copies in any of these languages may be obtained direct from the office of the Board, price 1*s.* each, post free.

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Directory of Agricultural Associations.—This Directory was issued in 1910, and gives, so far as could be ascertained, a list of all the Societies and Associations having reference to Agriculture and its allied industries, with the name and address of the Secretary in each case.

A copy of this Directory may be purchased, either directly or through any bookseller, from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C.; or Oliver and Boyd, Tweeddale Court, Edinburgh; or E. Ponsonby, Ltd., 116, Grafton Street, Dublin; price 9*d.*, by post 10½*d.*

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NOTICE.

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THE JOURNAL
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JANUARY, 1912.

PARTIAL STERILISATION OF SOIL FOR GLASSHOUSE WORK.

E. J. Russell, D.Sc., and F. R. Petherbridge, B.A.
Rothamsted Experimental Station.

Partial Sterilisation and What it Does.

The grower under glass, working against time and season, is compelled to make every condition as favourable as possible for his plants. He maintains by artificial means a proper temperature and water supply, he does his best to secure adequate light, and he uses such soils and manures as are best suited to the crops he is growing. He soon finds, however, that his particular crop is not the only thing his soil brings forth; the warmth, moisture and food that he so liberally supplies also encourage a host of other living things: woodlice, centipedes, millipedes, white worms, springtails, eelworms, and scores of fungi; and he may even have the mortification of finding that his own crop fares very badly through the activity of these parasites, the roots being invaded by eelworms, the stems and leaves by parasitic fungi, and the fruits by various disease organisms. Before very long his soil may be so infested with the germs of all these undesirables that it is little better than a deathtrap for his plants, and has therefore to be thrown out.

Many of these difficulties would vanish if all life could be destroyed in the soil, the manure, the chinks and crevices of the house, &c., leaving the crop as the only living thing. Growth under these simple conditions, however, although realisable in a scientific laboratory, is commercially impossible, because it now becomes a more difficult and expensive

matter to feed the plant. The straw manure that plays so large a part in commercial greenhouse work is not itself a food of plants, but has to be worked up into various suitable substances. The process can, of course, be effected artificially at a certain price, but it is done for nothing in the soil. The active agents are bacteria visible only under powerful microscopes, but so numerous that a thimbleful of soil may contain from five to fifty millions of them. Great as they are these numbers do not represent the whole possibility, for the bacteria no more have a clear field than anything else, and never work at their maximum efficiency under natural conditions. Thus neither of the two living things the grower really wants—the crop and the food-making bacteria—can attain to their full development under the competition ordinarily going on in a greenhouse soil.

Recent experiments have shown that it is possible to simplify very considerably the population of the soil. The different inhabitants show very different degrees of susceptibility to heat and to poisons, the most resistant, fortunately, being the spores of some of the food-making bacteria, so that it is possible by selecting one's poisons to kill off various groups—not very sharply, of course, because there is considerable overlapping—and finally to kill everything, leaving a perfectly sterile soil. The same object may be attained by using various degrees of heat. Certain other effects are produced as well: the poison has some chemical or other action on the soil, and the heat causes some decomposition, but the net result of treatment with the less violent poisons and degrees of heat is that the food-making bacteria now have a clearer field, and can multiply and make much more food than before. Such treated soils are therefore well suited for glasshouse work because they are free from harmful and competing organisms. This differential treatment, whereby some organisms are killed and others are spared, is called Partial Sterilisation.

The effects of partial sterilisation are:—

(1) the food-making processes in the soil are geared up so that the plant gets a larger supply of food than before;

(2) the food is not quite the same as usual because some of the bacteria have been killed; there are also some new sub-

a *b*

FIG. 1.
Chrysanthemums struck in untreated and in treated compost: *a*. Compost heated to 200° F. *b*. Untreated compost. (Stansted White.)

c *d*

FIG. 1 (*continued*).
c. Untreated compost. *d*. Compost treated with toluol. (Reginald Vallis.)

stances present in the soil; the plant, therefore, develops rather differently than before;

(3) disease germs, weeds, &c., are killed.

For some time past we have been conducting experiments in our own and other glasshouses, and we propose in this paper to set out our results, to describe methods of partial sterilisation that can be carried out in practice, and more especially to describe the objects to be attained, so that the grower who feels that he can cheapen the methods shall know the nature of his task.

The Effect of Partial Sterilisation on the Food Supply of Plants.

Two cases arise in greenhouse practice: (*a*) the plant is put up in a suitable compost and left without much added manure; (*b*) it is regularly and heavily (often excessively) manured with a variety of substances. Only in the first case is adequate use made of the extra food obtained by partial sterilisation; where large quantities of food are already added it is obviously useless to look for any benefit by adding more.

(*a*) *Plants grown in compost, but not frequently manured: Chrysanthemums.*—Mr. H. Burton Tate having very kindly allowed us access to his Harpenden glasshouses, we divided the compost into which the chrysanthemum cuttings were to be struck into three parts, heating one by steam to 200–210° F., treating another with toluol ($\frac{1}{2}$ per cent.), and leaving the third untreated. The compost was made up in the usual way by the head gardener, who also took the cuttings and carried the plants through as in the ordinary practice of a good private glasshouse. The cuttings were put in on December 5th, 1910, and were all found to strike at about the same time, no consistent differences being observed. They were potted up on March 10th, 1911, when it was noticed that the plants in the untreated soil had made rather better roots than the others. The plants were then transferred to a cold frame. Before long those in the treated soil began to go ahead, and on July 13th, when the photographs given in Fig. 1 were taken, they had larger leaves, stouter stems, shorter internodes, and generally a sturdier and altogether more promising aspect than those on the

untreated soil. In spite of their improved growth they had no appearance of coarseness or rankness. The advantage of the treatment is obvious; it is well known that attempts to force chrysanthemum cuttings by stimulating manures may lead to disaster, but we saw no sign of any ill effects on our plants.

Spinach.—This crop was grown under glass by one of us in a good loam rich in chalk. The plants in the heated soil (200–210° F.) made good growth, producing large leaves of a rich green colour, and showing little tendency to run to seed. Those in the untreated soil were much smaller and ran to seed more rapidly. The relative weights of the plants obtained were:—

Time of Sowing.	Early Spring.	Summer.	Autumn.
Untreated Soil	100	100	100
Heated Soil (200–210° F.) ...	447	150	184

In our experience it very commonly happens, as here, that the most marked effects are produced on the early spring crops.

Radishes.—This crop was grown along with the spinach in some of the same soil. Seven successive sowings were made, but no manure was supplied; the first three crops were much larger and earlier on the heated soil, but the last three were practically alike on both soils. The relative weights were:—

	1st Crop.	2nd Crop.	3rd Crop.	4th Crop.	5th Crop.	6th Crop.	7th Crop.
Untreated Soil ...	100	100	100	100	100	100	100
Heated Soil (200–210° F.) ...	216	355	172	128	103	114	103

After the seventh crop the heated soil was reheated and sown with an eighth crop; it was now found to be markedly superior to the untreated soil, giving a yield of 186 against 100 on the untreated.

These results show how advantageous partial sterilisation is for soil thrown out from a greenhouse or a spent hot bed into a cold frame, and sown with crops that have to go through without much feeding or attention.

Tomatoes in a Cool House.—A large grower of tomatoes at Waltham Cross kindly furnished us with a quantity of the soil used in that district for commercial growing. The seed was sown in the usual way on February 22nd,

1911. The young plants took longer to come through in the steam-sterilised soil than in the other soils. They made best growth in the soil heated to 130° F., the difference showing clearly by March 6th; a little later those in the soils treated with toluol and carbon disulphide * began to go ahead, but not until three weeks had elapsed after sowing did the plants in the steam-sterilised soil even catch up to those in the untreated soil, and it was eight weeks before they began to show any marked superiority. Flowers appeared first on the plants grown in the soil heated to 130° F. and in the steam-sterilised soil dressed with basic slag, and last on those in the untreated soil. The plants on the treated soils not only lasted longer, but produced much more fruit than those on the untreated soil. Some of them are shown in Fig. 2. The weights were :—

—	Untreated.	Partially sterilised by				
		Heat.			Chemicals.	
		200°	200° + basic slag.	130°	Toluol.	Carbon disulphide.
Relative plant weight, dried (leaves, stems, &c, no fruit)	100	132	123	119	112	117
Relative weight of fruit ...	100	342	332	339	366	346
Actual weight of fruit per plant (grams)	160	546	530	540	585	553
Fruit produced per 100 parts of dry plant weight	780	2,020	2,110	2,220	2,540	2,300

In this experiment the plants were not fed, our object being to ascertain what the unaided soil can do after it has been treated. It will be noticed that the extra growth of leaf is not produced at the expense of the fruit, for we obtained much more fruit per 100 parts of plant weight off the plants on the treated than on the untreated soils.

We do not wish to lay too much stress on the actual fruit increase obtained, because there were only five plants in each set, and fruiting is very much affected by details of management. We can, however, legitimately conclude that

* At the rate of ½ per cent., *i.e.* 1 gallon per ton.

partial sterilisation has caused a considerable increase in yield of fruit.

Vines.—We have not ourselves made any experiments on vines, but from results communicated to us it appears that partial sterilisation has produced marked increases in growth. The method adopted was to inject toluol into the borders.

Flowers.—Simultaneously with the spinach and radish experiments a number of flowering plants—Clarkias, Verbenas, Nicotianas, Dianthus—were tried, and all gave better growth and more flowers on the steamed than on the untreated soil.

Partial Sterilisation and Food Supply: (b) Plants regularly and sufficiently manured.—If the plant is to be supplied with regular and sufficient doses of manure no advantage is likely to be seen from the food derived from the soil by bacterial action, for no plant can utilise more than a certain amount of food. In such cases partial sterilisation is advantageous only for its secondary effects, which may not always be worth having at the cost. Examples are furnished by some of the plants grown in Mr. Tate's glasshouses. The compost was made up freshly with virgin loam and other clean materials, everything being free from disease organisms and pests, as the subsequent growth proved; the plants were also liberally manured.

Cinerarias certainly started somewhat better in the steamed compost, and began coming into flower before those on the untreated soil, but their weekly dose of cow manure water clearly sufficed for their needs, the limiting factor now being not food but something else. Consequently when the plants were moved into the conservatory there was little if anything to choose between them, and nothing to justify the trouble of partial sterilisation.

Carnations and *Malmaisons* fed regularly with a proprietary carnation manure made full growth on the untreated soil, and therefore did no better on the steamed soil. The same thing happened in the case of *Schizanthus*.

Melons ripened rather sooner on the steamed soil than on the untreated, and in the case of one variety (Sutton's A1) gave a more rounded and somewhat smaller fruit. Otherwise the crops on the two soils seemed identical. The experi-

a *b* *c*

FIG. 2.

Tomatoes grown in turf in cool house, no manure added. *a*. Soil heated to 130° F. *b*. Soil untreated. *c*. Soil heated to 200° F.

a *b* *c*

FIG. 3.

Young tomato plants showing retardation, even at this stage, in soil heated to 200° F., but accelerated growth in soil heated only to 130° F. *a*. Soil heated to 200° F. *b*. Untreated soil. *c*. Soil heated to 130° F.

ment, however, requires to be repeated with a larger number of plants.

Cucumbers.—The gross-feeding cucumber benefited more from partial sterilisation, the plants fruiting better on the steamed soil. A similar result has been obtained in another house, where also the earlier ripening on the steamed soil was very noticeable.

SECONDARY EFFECTS OF PARTIAL STERILISATION.

The secondary effects of partial sterilisation arise from two causes: (1) the plant does not live on its usual nitrates but on ammonia, at any rate until reinfection of nitrifying organisms has taken place; other soluble compounds may be utilised also; (2) some of the soil decomposition products have a physiological action on the plant, modifying it in certain ways.

Retardation of Germination and Seedling Growth.—The grower's first experience of partial sterilisation may be very disappointing; he will often find that seed germinates more slowly and produces smaller seedlings in the treated, and especially the steamed soils, than in the untreated soils. The precise cause of the retardation is not yet ascertained, and consequently no remedy can be suggested, but it probably arises from the excess of ammonia and other decomposition products, which are useful enough for older plants, but form too aldermanic a diet for the seedling. The amount of retardation varies with the soil, the method of sterilisation, the seed, and the conditions of growth. It was very slight, if it occurred at all, on the chalky loam used for the spinach and radish experiments. It was very marked in a rich cucumber soil, and still more on a turf, and was more pronounced the higher the soil had been heated, up to a certain point. There are indications, however, that the harmful effects passed off after a time. Often there was no retardation, but an acceleration both of germination and of seedling growth in soil heated only to 130° F.

Poor seeds and old seeds appear to be most affected. Tomatoes appear to be specially susceptible, more so perhaps than cucumbers. Different varieties are not equally susceptible. In working with melons, for ex-

ample, Sutton's A1 recovered in four weeks, while Ringleader took five weeks. It commonly happened that recovery was delayed till after the third and fourth leaves were out.

Figs. 3 and 4 illustrate the two common cases; in Fig. 3 steam-sterilisation has produced some condition detrimental to the young plant which was not produced at a temperature of 130° F.; in Fig. 4, however, the harmful effect had passed off very rapidly. There was no obvious reason for the difference.

Soon after the new leaves are out the retarded plants make more rapid growth and soon catch up the plants on the untreated soil, and, if no manure is being given, pass them. The retardation therefore need cause no anxiety, but it is an undoubted disadvantage, and is receiving careful investigation.

Fungus Development.—Some of the products formed by heating rich soils to 200° F., or more, are very favourable to the development of certain fungi, and if any of their spores happen to be about (as is usually the case) a rapid growth of mycelium begins in the surface layer, followed by a crop of small, yellowish, saucer-like fructifications. The fungus then disappears, and is not seen again; it causes no injury to the plant so far as we have been able to observe, but while it lasts it sometimes binds the surface of the soil so solidly that the young plant may have a difficulty in getting through. The common form in our experiments was a *Rhizina*, probably *R. inflata*; it did not occur to any marked extent on the soils heated to 130° F. or treated with toluol or carbon disulphide.

Root Action.—The root action is sometimes, but not always, retarded in the early stages of growth in soils heated to 200° F. Like the retardation of germination, the effect is erratic. The same grower has obtained in August a good root development, and in January a very poor one, in heated soils. This problem also is under investigation with the view of discovering a remedy.

Later on, however, the soil heated to 200° F. stimulates root action in a most remarkable way. Applied as a top dressing to pots containing tomato plants or to borders where cucumbers were growing, it caused a rapid growth of fibrous

a *b* *c*

FIG. 4.

Young tomato plants grown in conditions similar to those of Fig. 3, but showing acceleration in both the heated soils. *a*. Soil heated to 130° F. *b*. Untreated soil. *c*. Soil heated to 200° F.

a *b* *c*

FIG. 5.

Roots of tomato plants grown in (*a*) Tomato "sick" soil heated to 130° F., (*b*) some of the same lot of soil untreated, (*c*) the same soil heated to 200° F.

root, as seen in Fig. 5. The effect is not easy to explain, and is not shown to nearly so marked an extent in soil heated to 130° F., although at this temperature eelworms and other pests are killed, while it is scarcely shown at all in soils treated with toluol and carbon disulphide. But steamed soil is a very useful medium for plant growth wherever good fibrous root development is wanted.

The Appearance of the Plant.—Plants grown on steamed soils show, in comparison with those on untreated soils, larger leaves, stouter stems, a darker green colour, shorter joints, and a more compact vigorous habit. The actual amount of shortening of the joints depends on the plant; it was not noticeable in our tomatoes, but was very distinct in the chrysanthemums, and we have observed it in cucumbers; it is very marked in our outdoor experiments with rye, mustard, &c.

In spite of the extra growth on the steamed soils the plant is not rank or coarse, a result we attribute to the nature of the food it is now taking up. It flowers earlier and produces a greater quantity of fruit than others on untreated soils, excepting, of course, where the difference between the soils has been swamped by liberal manuring.

Quality of Fruit.—In the case of tomatoes and cucumbers, the only fruits we have as yet studied, the quality of fruit is better on the steamed than on the untreated soil. During the present season cucumbers grown on heated soils in a large commercial glasshouse have shown a marked improvement in quality, although there was no noticeable increase in quantity, which indeed is probably already a maximum for the general conditions. Our own tomatoes were sent to an expert of irreproachable taste and judgment, who arranged them as follows:—(1) From toluol-treated soil, finest in flavour; (2) from steamed soil, very good, sweet; (3) from untreated soil, poorest in flavour.*

Leguminous Plants.—As is well known, leguminous plants differ from others in the manner of their nitrogen nutrition,

* A grower who now partially sterilises soil on a large scale has kindly offered to put on rail a cart-load or truck-load of steamed soil at a nominal charge in order that anyone interested may try the effect of such soil on plant growth without having to put up a steriliser. We shall be happy to put anyone into communication with this gentleman.

and they show certain peculiarities in steamed soil. They are particularly susceptible to the toxic substance present; clover still refuses to grow in pasture soils heated to 208° in March, 1908, although it is sown three or four times a year. Toluol, however, has much less drastic an effect and will even produce a marked increase in crop if the proper nodule organisms are added. Much depends on the nature of the soil: the chalky loam already referred to produced, even after steaming, no bad effect on dwarf beans and sweet peas although no improvement was seen, whilst it not only caused no injury to sainfoin, but led to an increased crop. Mr. Holmes, of Norwich, also tells us that he has raised sweet peas perfectly well on heated soil. Much further information is wanted about the effect of soil treatment on the growth of leguminous plants.

Effect of Partial Sterilisation on Insect and other Pests, Weed Seeds, etc.

Eelworms.—From the growers' point of view the eelworms of the soil may be divided into two groups: the parasitic forms, such as *Heterodera radicicola*, which causes the knots or club on the roots of tomatoes and cucumbers; and the free-living forms, *Rhabditis, Diplogaster,* &c., which so far as our observations go are without injury to the healthy plant. It is easy to demonstrate the presence of the free living forms in a soil, because they tend to cluster round decaying vegetable or animal matter, &c.; thus they may readily be trapped in a piece of meat or of mangold, or in a large seed such as the broad bean, left a few days in the moistened soil. But we know of no certain way of detecting *Heterodera* except by examination of the roots, or the washings from the roots, of the host plant.

The conditions of greenhouse culture favour the development of the parasitic eelworms to an extraordinary extent. Fig. 5*b* shows the root of a tomato plant grown on a soil from a tomato house; it is no exaggerated specimen, and demonstrates one cause why tomatoes cannot be grown indefinitely in the same soil. A number of soils have been sent to us from commercial cucumber and tomato houses, so-called "sick" soils, all of which contained quantities of *Hetero-*

dera radicicola, and of the free-living *Rhabditis terricola* and *brevispina*, *Diplogaster* sp., together with some *Cephalobus*, *Plectus granulosus*, &c. *All these forms are killed by heating the soil to* 140° *F.*, and when we heated the soil to 200° F. and grew tomatoes, we obtained the other root shown in Fig. 5*c*.

We have never observed reinfection of *Heterodera* in the steamed soil, although we took no special precautions to exclude it; we did, however, find that the free-living *Rhabditis* and *Diplogaster* got in again unless the soil was kept carefully covered up. The point is of considerable importance to the horticultural investigator, because it shows that the subsequent presence of these easily detected free-living forms is no necessary proof that a certain treatment has failed to kill eelworms, nor does it imply that the really dangerous *Heterodera* is present.

Toluol and carbon disulphide readily kill all free-living forms, but not all the *Heterodera*. These, however, have more opportunities of escape from a poisonous vapour than the others, since some of their eggs are enclosed in dead females, the body walls of which make a good protective membrane.

Other Animals.—The untreated "sick" soils received from the tomato and cucumber houses also contained numbers of other animals, including white worms (*Enchytraeidae*), wireworms, springtails, millipedes, centipedes, mites, woodlice, &c., but all were killed at 200° F., together with their eggs, so that none of them subsequently reappeared from the soil. There was, of course, some reinfection from outside, springtails, &c., getting in from neighbouring pots. Lower temperatures (130° F.) were in our experiments also effective, but we do not recommend them for practical work. Carbon disulphide killed all woodlice and other animals, but toluol was less fatal.

Fungoid Pests.—As we had no outbreak of any fungus disease, in spite of our use of "sick" soils, we were not able in the present series of experiments to study the effect of partial sterilisation on the fungus spores. Mr. W. Dyke has been studying the wilt fungus (*Neocosmopara Vasinifecta*) that attacks the roots of cucumbers and melons, doing con-

siderable damage in certain districts, and informs us that steam sterilisation and treatment with a certain disinfectant effectively kills the spores and leaves the soil capable of carrying perfectly clean healthy plants. An outbreak of "gumming" (*Cladosporium scabies*) occurred on the cucumbers in a house where some of our experimental plants were growing, but there was no obvious difference in the incidence of the disease between the treated and the untreated sections of the borders.

Weed seeds are all killed at 200° F., so that boxes or pots of steamed soil are readily distinguished from untreated soil by their freedom from weeds.

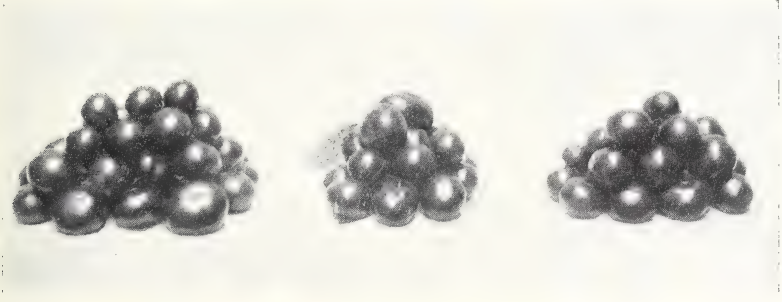
THE TREATMENT OF GLASSHOUSE "SICK" SOILS.

Our investigations show that "sickness" of tomato, cucumber, and other soils is due to two causes acting together —a lowered efficiency of the plant food-makers, and an accumulation of disease organisms. Both these causes are removed by partial sterilisation, most completely by heating to 200° F. which has the further advantage of effecting some decomposition of the organic matter, but also to a greater or less extent by various antiseptics. We have carefully studied eight "sick" soils, and found in every case that partial sterilisation effected a satisfactory improvement. The chemical and other examinations that have been made need not be referred to here; it is sufficient to give the weight of the plants to show that the fertility of the soil has been restored, and the weight of the fruits to show that the new growth is not simply rank foliage but leads to greater fruit production. (See table on next page.) Fig. 6 shows two of the plants, and Fig. 7 shows the relative yield of fruit.

The present method of dealing with "sick" soils is to throw them out from the glasshouse and replace them by virgin soils, carted sometimes from a considerable distance. "Sickness" so speedily sets up in a cucumber house, with its high soil and air temperatures (80° F. or more), and its extraordinarily high manure and water supply, that the soil has to be thrown out each year at considerable expense, and at the sacrifice of all the valuable manurial residues. Soil in a tomato house, which is run at an altogether lower pitch, lasts

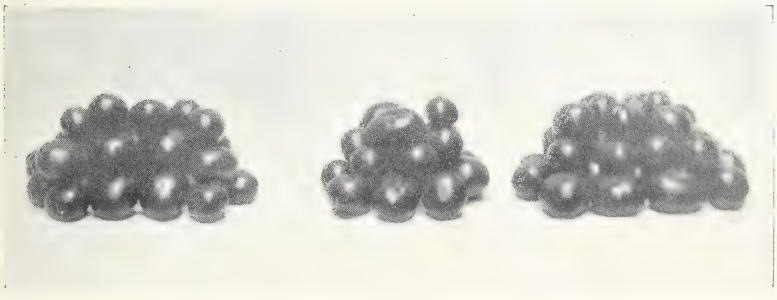
a *b*

FIG. 6.
Tomato plants grown in (*a*) tomato "sick" soil and (*b*) some of the same lot of soil heated to 200° F.



a *b* *c*

FIG. 7.
Fruit obtained from tomatoes raised on untreated and on treated "sick" soils. *a*. Soil heated to 200° F. *b*. Untreated soil. *c*. Soil heated to 130° F.



d *e* *f*

FIG. 7 (*continued*).
d. Soil treated with toluol. *e*. Untreated soil. *f*. Soil treated with carbon disulphide.

(*a*)—CUCUMBER SICK SOIL (B).

—	Untreated.	Partially sterilised by Heat. 200°.	200° + basic slag.	130°.	Chemicals. Toluol.	Carbon disulphide.
Relative plant weight, dried (leaves, stems, &c., no fruit)	100	163	175	125	139	116
Relative weight of fruit ...	100	204	225	129	119	124
Actual weight of fruit per plant, grams	320	654	722	415	380	398
Fruit produced per 100 parts of dry plant weight	1,280	1,600	1,640	1,340	1,100	1,360

Some club on untreated, not on other, soils.

(*b*)—TOMATO SICK SOIL (MC).

Relative plant weight, dried (leaves, stems, &c., no fruit)	100	188	178	112*	144	138
Relative weight of fruit ...	100	255	241	159	200	179
Actual weight of fruit per plant, grams	215	550	519	343	431	386
Fruit produced per 100 parts of dry plant weight	1,360	1,840	1,840	1,940	1,900	1,800

* Heated to 120° only.

(*c*)—TOMATO SICK SOIL (MT).

Relative plant weight, dried (leaves, stems, &c., no fruit)	100	170	—	103	107	104
Relative weight of fruit ...	100	161	—	116	133	138
Actual weight of fruit per plant, grams	446	720	—	518	595	615
Fruit produced per 100 parts of dry plant weight	1,575	1,525	—	1,775	1,975	2,100

Both in (*b*) and (*c*) very much club on untreated soil, some on soils treated with toluol and carbon disulphide and heated to 120°, very little on soil heated to 130° F., and none on soil heated to 200° F.

(*d*)—TOMATO SICK SOIL (Fed on two occasions).

Relative plant weight, dried (leaves, stems, &c., no fruit)	100	144	—	110	—	—
Relative weight of fruit ...	100	118	—	109	—	—
Actual weight of fruit per plant, grams	587	692	—	643	—	—
Fruit produced per 100 parts of dry plant weight	2,340	1,860	—	2,320	—	—

Some club on untreated soil, none on heated soils.

longer, but after several years also has to go. Our experiments show that this sick soil, after partial sterilisation, can again be made to yield full crops.

METHODS AND COST OF PARTIAL STERILISATION.

So far as the grower is concerned the whole problem resolves itself into one of cost. The advantages of partial sterilisation are:—

(1) A greater utilisation of the plant food constituents of the soil, resulting from the increased efficiency of the food-making bacteria;

(2) freedom from such insect and fungoid pests as reside in the soil;

(3) economy of soil and residual fertilising material, in that spent soil, sick soil, &c., can be used again.

These advantages do not appeal with equal force to all growers; they are worth very little to the man who is isolated from all risk of infection and has abundance of virgin soil and manure at his disposal; they become more significant where supplies of virgin soil and manure are more restricted, or, what is the same thing, have to be paid for; and, finally, they become very important for cucumber growers who annually sacrifice many tons of rich soil—some of it even richer than farmyard manure *—because it is no longer effective enough for them.

It is obviously futile for us to consider any methods of partial sterilisation that cost more than the advantages are worth. Fortunately the maximum value can be fixed by the value to the cucumber grower. The cost of wheeling out the old borders and purchasing and carting in new soil is variously estimated, but has been put by growers with whom we have discussed the subject at 2*s*. to 3*s*. 6*d*. a ton in a crowded district. In such a case the grower would still be in pocket if he paid 2*s*. a ton to have his old soil treated,

* Two cucumber soils analysed by us had the following composition:

	Soil A.	Soil B.	Farmyard Manure (Rothamsted average).
Nitrogen	0·75	0·72	0·64
Phosphoric acid	0·56	0·73	0·23
Available phosphoric acid ...	0·36	0·46	
Potash	0·54	0·50	0·32
Available potash	0·12	0·10	

because by so doing he would recover some of the manurial residues it contains. We can therefore seriously consider methods costing 2*s.* a ton, and, of course, the lower we can get the price the better.

Sterilisation by Heat.—For a variety of reasons we consider that partial sterilisation by heat is the most effective method at present available. We say *at present* advisedly, because we have not yet examined all possible methods of chemical treatment, the advantages of which are obvious. The soil should reach a temperature of 200° F., but need not pass 210° F.; it should be maintained for an hour or more at a temperature exceeding 180° F. It is immaterial, so far as our present results go, whether dry heat or moist heat is used, *i.e.*, whether the soil is baked or steamed, but if steam is used the soil must not be allowed to get too wet, but the steam must blow through at a sufficient rate to prevent complete condensation. After sterilisation the heap should not be exposed more than necessary to the rain, as plant food rapidly begins to form, and is very liable to be washed out.

Steam Heat.—Growers in this country and in the United States have for some time known that steaming the soil killed certain pests, and they have devised various methods of carrying out the operation. Probably the best plan is to blow high-pressure steam through a harrow-like implement with jets corresponding to tynes buried in the soil. The most economical pressure has yet to be determined; we saw the method worked at some large nurseries with steam pressure at 80–90 lb., and found that the temperature of the soil rose in two or three minutes to 212° F., and the soil remained nearly as dry as before. In this case the heating was continued for 15 minutes, and the soil then thrown into a heap, but so slowly did it cool (soil being a very bad conductor of heat) that even after five hours the temperature remained at 160° F., while at the end of a week it was still 75° F. Account was kept of the cost of the operation, including the hire of the engine and all other charges, and it worked out to 1*s.* 6*d.* a cubic yard, which at the modest reckoning of only 20 cwt. to the cubic yard,* is still

* Rich cucumber soil is lighter than ordinary arable soil which would be nearer 20 cwt. per cubic yard.

well within our limits. As one engine dealt with 40 yards of soil per day, the method has obvious advantages for the large grower.

In another nursery, where only an old boiler was available, low-pressure steam was blown through a heap of soil covered with sacks. After some time the soil was thrown into a heap as before; it was moist, but not over wet. The cost in this case was 1*s.* 2*d.* per ton, but no allowance was made for the boiler (it was not thought worth it), and, of course, the process was slower than the previous one.

Dry Heat.—Two methods have been suggested: (1) Oven methods; (2) Hot-air methods. Oven methods present some difficulty. Owing to its bad conductivity soil only allows heat to penetrate slowly, and the temperature of a mass of soil in an oven is for a long time very uneven, the inside remaining cold long after the outer layers have got hot. Apart from this loss of economy there is in some forms of steriliser a danger of overheating part of the soil and getting beyond 210° F., a temperature we see no advantage in exceeding.

Hot air may be made to pass through the soil, thus obviating the drawbacks to the oven method, but a certain amount of heat is wasted through the evaporation of water from the soil.

On the other hand, the great advantage of the dry-heat methods is that they can be worked by means of the waste heat from the flues. When this is done there is no expense for firing, and the cost of treatment is reduced simply to labour and outlay on capital, neither of which need be large. Mr. Holmes tells us that he sterilises his soil in this way at 5*d.* per ton, inclusive of everything. The soil is left in the heater for about seven hours, three charges of about a ton each being treated in 24 hours.

Fuel Requirements and Efficiency.—The amount of water in the soil is a very important factor in determining the cost of the process. Dry soil requires only one-fifth the amount of heat that water requires to raise its temperature. Consequently there is a great increase in the fuel expenditure directly one begins to handle wet soil. This fact is brought out by the following results recently obtained by us:—

Soil.	Rich cucumber soil.			Tomato soil.		Arable soil.	
	Moist.	Drier.	Air dry.	Moist.	Dry.	Moist.	Dry.
Moisture (per cent.)	41·6	25	5·6	22·4	8·9	14·7	6·0
Specific heat	0·58	0·38	0·23	0·39	0·22	0·30	0·22
Thermal units (B.T.U.) required to raise 1 lb. of soil from 52° F. to 212° F. ...	92	61	37	62	35	48	35
No. of lb. of soil heated per lb. of fuel burnt, assuming 100 per cent. efficiency throughout	130	197	320	193	340	250	340

From these and other results we have drawn up the following rule by which the grower can form an approximate estimate of the number of thermal units [B.T.U.] required, if he simply knows the amount of moisture in his soil :—*Multiply* per cent. of dry soil (*i.e.*, 100 minus percentage of moisture) by 23 if the soil is rich, or 21 if it is poor, *add* 100 × percentage of water, *multiply* by 1·6, and *divide* by 100—*e.g.*, to find B.T.U. for rich cucumber soil containing 41·6 per cent. of water, 100 − 41·6 = 58·4

$$\begin{array}{r} 58{\cdot}4 \times \ 23 = 1342 \\ 41{\cdot}6 \times 100 = 4160 \\ \hline 5502 \end{array}$$

$\frac{5502 \times 1{\cdot}6}{100} = 88$. Found by trial, 92. The rule breaks down for dry soils.

The number of pounds of soil heated per lb. of fuel burnt (100 % efficiency) is obtained by dividing the B.T.U. into 12,000, the calorific power of average quality coal.

The 100 per cent. efficiency is, of course, unattainable, partly because of the imperfections of boilers and boilermen, but mainly because it involves perfect retention and condensation of the steam, which is undesirable, because it would make the soil too wet. It will be a nice problem for the horticultural engineer to see what degree of efficiency can be attained; the best we have seen as yet is about 30 per cent., *i.e.*, 57½ lb. of soil heated per lb. of fuel, the cost being 3¾*d.* per ton of soil sterilised.

Chemical Treatment.—In principle the chemical treatment is much the simplest and the cheapest. If the right chemical could be found it would only have to be put into the soil and the work would be done; there would be no carrying soil to the steriliser and bringing it back again, and no trouble about the efficiency of the heating process. The following requirements have to be fulfilled: the substance must be (1) cheap; (2) volatile or decomposable, so that it disappears when its work is done and causes no subsequent interference

with plant roots or food-making bacteria; (3) fatal to eel-worms and other animals, to fungus spores, and to organisms interfering with the food-making bacteria; (4) no more harmful to food-making bacteria than a temperature of 180° F. Some commercial waste product is clearly indicated, and a suitable substance could no doubt be found among the numerous coal-tar products. Our own experiments have been made with pure substances, with the view of settling the various preliminary problems; it is now possible to study some of the waste products obtainable by the grower.

CONCLUSIONS.

1. Partial sterilisation of soil increases the supply of food for the plant, somewhat alters the growth of the plant, and kills insect pests.

2. It may cause a temporary retardation in germination and in early growth, the amount of which varies according to the nature of the soil, the seed, and the general conditions.

3. In our experiments it has not proved advantageous for pot work where abundant supplies of clean virgin soil and manure are available.

4. It is, however, very useful for work with borders, cold frames, and for plants that are to run for some time without manure. It leads to better root development, sturdier and healthier plants, earlier flowering, more prolific fruiting, and better quality of fruit.

5. It is particularly useful for commercial glasshouses where soil pests are a source of trouble, and soil "sickness" sets in.

6. At present the most effective method of partial sterilisation is to heat the soil to a temperature above 140° F., but not exceeding 212° F. Very satisfactory results have been obtained between 180° and 200° F.; ½ cwt. or less fuel is required per ton of soil; capital and labour charges depend on the speed at which the process is to be worked. Our experiments indicate that effective chemical treatment is also possible, and would, of course, be much simpler, but we have not yet tested a sufficient number of commercial products to discuss the problem from the grower's point of view.

HISTORY OF SCAWBY CREDIT SOCIETY.

OF the 44 Agricultural Co-operative Credit Societies now in existence in England and Wales, the Scawby Credit Society is the oldest. It may therefore justly claim to be the pioneer in this country of the movement for enabling small agriculturists, by combining their credit, to obtain small loans for agricultural purposes on easy terms; and as it has satisfactorily achieved its object, and has now attained a sound financial position, an examination of its history may not be without profit to younger Credit Societies, or to agriculturists who feel the need of some such means of obtaining credit on more favourable conditions than are at present available to them.

Scawby is a rural parish in Lincolnshire, about two miles from the market town of Brigg. It has a population of about 1,000, and an acreage under crops and grass of 2,825 acres, of which two-thirds are under crops, and one-third under grass. The land is held in 39 holdings, of which 26 are under 50 acres each. A number of the small-holders have other occupations besides agriculture. There is no other local industry, and the parish is typical of many other country parishes in England.

On July 3rd, 1894, after a public meeting had been held under the Chairmanship of Mr. Sutton Nelthorpe, the principal landowner in the parish, and had been addressed by Mr. H. W. Wolff, a leading authority on Co-operative Credit, and by Mr. Leman, Secretary of the Agricultural Banks Association, it was resolved to form an Agricultural Credit Society for the parish of Scawby. Further meetings were held to discuss the proposed rules, and the Society was finally registered under the Friendly Societies Act on November 1st, 1895. The rules provide that the object of the Society is to create funds to be lent out to its members, and that every loan must, in the opinion of the Society, hold out a sufficient prospect of repaying itself by the production, business, or economy which it will enable the borrower to effect. No part of the funds can be divided by way of profit, bonus, dividend, or otherwise among the members; any surplus accruing to the Society after payment of the costs

of management must be carried to a Reserve Fund, which can be drawn upon only to meet exceptional losses by vote of the General Meeting of the members. Only persons (male or female (owning or occupying land or residing in the parish of Scawby or its immediate neighbourhood can be members, and each applicant must be approved by the Committee. Each member has only one vote, and all the members are liable to an equal levy, should funds be required to make up any deficiency in the working of the Society—that is, all the members are equally, jointly, and severally liable for any debts incurred by the Society, and no limit has been fixed for their liability. There are no shares and no share-capital.

The Society started with 9 members, but by the end of 1895 there were 20. The number of members has since risen gradually until at the end of 1910 there were 32, of whom 11 were small farmers, 3 market gardeners, 3 blacksmiths, and 2 carpenters, besides a butcher, a horse-dealer, a carter, a woodman, a miner, a foreman, and 2 labourers, most of whom, in addition to their main occupations, cultivate small holdings or allotments. The affairs of the Society are managed by the Chairman and a Committee of 6, annually elected by ballot at the general meeting. They at present consist of 3 small-farmers, a carpenter, a blacksmith, and a woodman. Mr. Spencer, the rate-collector of the parish, has from the first, as Secretary and Treasurer, kept the accounts and minutes without any salary. Mr. Nelthorpe has been Chairman of the Society since its foundation.

One of the first requisites for the working of the Society was the raising of money to be lent to the members. With this object the Chairman offered to guarantee £100, and was joined by Mr. Yerburgh (now Chairman of the Agricultural Organisation Society), who proposed to guarantee £50, and by the Rev. H. F. Oliver, the Vicar, who offered either to guarantee £50 or to lend the Society £100 at 3½ per cent. It was afterwards found that the rules as they then stood (they have been altered since) prevented the adoption of this system of guarantees, and the ultimate arrangement made was that an account was opened with the local branch of a Joint Stock Bank, to which the Chairman, both on his own behalf and as representing the Society, gave

a guarantee limited to £100 for any sums that might be due to the Bank by the Society. Under this guarantee the Society obtained funds from the Bank, and at one time its over-draft amounted to £94, but for the last two years, owing to the growth of deposits, it has not required to over-draw its account at the Bank, and has generally had a balance to its credit. The Bank charges 5 per cent. on overdrafts, and allows 2 per cent. on current account credit balances.

The Society also offered to take deposits at 3 per cent. interest, and at the end of the first year had obtained in this way £39, but by the end of 1910 it had so gained the confidence of the villagers that the amount on deposit with the Society at 3 per cent. had mounted up to £186, including a considerable sum deposited by the village Dividend Society, formed of working people. Deposits must be left with the Society for a period of not less than three months, and one month's notice must be given of withdrawal; and the Society retains the right to return any surplus of deposits it does not require, on giving one month's notice to the depositor.

The main object of the Society is to make loans to its members for profitable purposes at a low rate of interest. The first loan granted was one of £30 to a small-holder to enable him to buy lambs to consume feed, the full profit of which he would not otherwise have obtained, and was made repayable in 8 months. In the first year only 2 loans were granted, in the next 1, and in the third 2, but the number of loans gradually increased, and in 1910 6 loans were made, aggregating £175. During the last 16 years the Society has made to its members 78 loans, aggregating £2,300, and averaging nearly £30, the smallest loan being £5, and the largest £50, which is the maximum loan allowed by the Act. At first the Society charged 5 per cent. per annum interest on loans, but it soon raised this rate to 6 per cent. in order to build up a reserve fund. When that object had been attained, it 3 years ago reduced the rate to 5 per cent., at which rate its members can now obtain from the Society the capital they require for their agricultural operations.

Loans to members must be expended on some specific purpose, approved by the Committee as likely to be profitable to the borrowing member. The purposes for which

loans have been granted have been, for example, to enable the borrower to buy cows, sheep, lambs, pigs, or seed, or to hold over stock or corn for better prices. Loans are generally made repayable at the time when the profits of the transaction are likely to come in to the borrower and for periods varying from 3 months up to 2 years, which is the maximum period allowed by the Act. The longer term loans are usually made repayable by instalments. In order to secure the Society against loss, the Committee require the borrower to give security approved by them for the punctual repayment of the loan, generally in the form of two sureties, who may or may not be members of the Society. The Committee carefully watch the utilisation of the loan on the object for which it was granted, and insist on punctual repayment, though they give the borrower time on good cause shown. On three occasions they have had to call on the sureties to make good part of the loan, but the Society itself has made no bad debts, and has incurred no loss. It is believed that the sureties ultimately recovered the amounts they had paid. No repayments of loans were overdue at the end of 1910. Several of the members say the existence of the Society has enabled them to undertake profitable transactions with sums borrowed from the Society, which they could not have obtained elsewhere, and one family at least has, by its own thrift and industry, and with the help of successive loans from the Society, risen from the position of day-labourers to that of substantial small farmers.

One borrower repaid his loan three months before it was due, cheerfully paying interest for the full term for which it was borrowed, as he said that the loan had benefited him greatly, and he wished in return to benefit the Society. Another man, who had borrowed £5 to enable him to hold over his fat pig for a better price, also repaid his loan before it was due, with interest in full, saying he considered the transaction had left him ten shillings to the good.

Seeing that the whole work of the Society is done for nothing, the expenses of management, which consist chiefly of cost of stationery and affiliation fees to the Agricultural Organisation Society, have been small. In 1910 they amounted only to 12*s*. for the year. And, seeing that for

the bulk of the Society's transactions it borrows from depositors at 3 per cent., and lends to members at 5 per cent., it has a margin of profit on such transactions of £2 on every £100 every year. During the first year there was a loss, as the Society had to pay a registration fee of £1 (no fee is now charged for registration), but since then there has been a profit every year, beginning with 10*s.* in the second year, and rising to £5 6*s.* 5*d.* in 1910. Under the rules all profits must be carried to a Reserve Fund, which has gradually mounted up year by year, until in 1910 it was £64 16*s.* 5*d.*, including a gift of £15 made to the Society by the Chairman. The Reserve Fund is the property of the Society, which pays no interest on it, so that any interest received on this surplus is clear gain to the Society, and a further means of adding to the Reserve Fund. This Fund cannot, under the rules, be divided among the members, nor can they derive any direct profit as sharers in the Society. Its uses are to give confidence to depositors, who see that the amount in reserve is readily available to meet their claims, and to the members, who feel that any unforeseen loss, such as the improbable failure of both borrower and sureties to repay a loan, can be met from the reserve fund without their having to contribute towards it. The interest on the Reserve Fund also goes to swell the income of the Society, and thus makes it possible to reduce the rate of interest charged on loans, as was done by the Society three years ago.

The financial position to which the Society has attained, as disclosed by its balance-sheet at the end of 1910, is highly satisfactory. It then possessed altogether £255, of which £153 had been lent out to members, and the remainder, which was in excess of the amount then wanted on loan by members, was mainly deposited with the Central Co-operative Agricultural Bank, Ltd., at 3 per cent. interest. Its liabilities were only £186 principal, and £4 10*s.* 6*d.* interest, due to depositors, and on this principal it paid only 3 per cent. interest. So that, as already said, its surplus profits, or reserve fund, amounted to nearly £65. It has acquired such good credit in the neighbourhood as to obtain on deposit all the money its members require as loans, and its members can borrow the capital they want for agricultural purposes at the

low rate of 5 per cent. per annum, or one penny per £ per month. Few agriculturists in England can borrow at a lower rate than this.

In 1910 the Reserve Fund equalled one-third of the total amount of the loans granted, and it is being added to at the rate of over £5 a year. It seems hardly necessary to go on increasing it at this rate, and the Society might, if it chose, utilise the advantage it has gained in some such way as the following:—

It might repay its Chairman his generous gift of £15, of which it now stands no longer in need, and so add to the self-respect of the members. The remaining £50 of its Reserve Fund it might deposit in a separate account with the Post Office Savings Bank or Local Joint Stock Bank, and so make it no longer a part of the working capital, but a true reserve, only to be drawn on by special resolution of the general meeting of the Society. It would receive on this at 2½ per cent. an annual interest of £1 5*s*., which would cover its present annual working expenses, and leave a small surplus. If it continued as at present to hold deposits of about £180 at 3 per cent., and to lend about as much to members at 5 per cent., it would have on this business a margin of £3 12*s*. per annum, which it could employ to pay a small salary to its Secretary, to whose good account-keeping much of its success is due. If it does not think it necessary to pay its Secretary a salary, then, seeing that the interest on its reserve more than covers the cost of the administration, it could actually now afford to lend money to its members at the same rate at which it can borrow—that is, so long as depositors lend it money at 3 per cent., it could make loans to its members at 3 per cent., and still go on adding to its reserve.

It will thus be seen that the Scawby Credit Society, besides being the pioneer Agricultural Credit Society in England and Wales, may well be taken as a model of good and successful management by small agriculturists who wish to combine their personal credit, and so obtain loans for their agricultural operations at a low rate of interest.

PROGRESS OF SCAWBY CREDIT SOCIETY

I.

Year.	Number of Members at end of Year.	Loans Granted during the Year.		Rate of Interest Charged on Loans.	Deposits Received during the Year. Amount.	Rate of Interest paid on Deposits.	Expenses of Management.	Profit or Loss on the Working of the Year.		Remarks.
		Number.	Amount.					Profit.	Loss.	
			£		£		£ s. d.	£ s. d.	£ s. d.	
1895	20	2	50	5	39 (includes £5 special loan)	3	1 0 0	—	0 18 7*	*Paid Registration Fee, £1.
1896	20	1	40	6	12	3	0 0 5	0 10 0	—	
1897	22	2	40	6	15	3	0 0 6	1 0 8	—	
1898	25	4	110	6	20	3	0 0 6	0 19 7	—	
1899	26	4	90	6	—	3	0 1 1	1 12 4	—	
1900	25	5	107	6	50	3	0 16 4†	0 8 0	—	† Paid Registrar, 10s.
1901	27	7	220	6	75	3	0 10 8	3 11 9	—	
1902	28	5	145	6	10	3	0 8 8	3 16 8	—	
1903	29	6	170	6	10	3	0 7 1	4 0 1	—	
1904	29	8	270	6	50	3	0 11 0	5 2 6	—	
1905	28	5	180	6	15	3	0 11 0	6 1 11	—	
1906	28	5	145	6	—	3	0 9 6	4 13 5	—	
1907	27	6	100	6	—	3	0 18 6	3 14 6	—	
1908	28	6	200	5	71	3	0 18 10	4 2 6	—	
1909	29	4	147	5	25	3	0 12 2	5 8 8	—	
1910	32	6	175	5	50	3	0 12 0	5 6 5	—	

II.

Year.	Assets at end of Year.				Liabilities at end of Year.				Total Profit or Loss to date at end of Year.	
	Cash.	Loans Due from Members.	Other Assets.	Total Assets.	Due to Banks.	Due to Depositors.	Other Liabilities.	Total Liabilities.	Profit.	Loss.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1895	—	50 12 4	1 12 4	52 4 8	11 7 9	39 4 6	2 11 0	53 3 3	—	0 18 7
1896	—	41 0 6	1 11 8	42 12 2	8 16 0	31 4 9	3 0 0	43 0 9	—	0 8 7
1897	0 0 3	41 7 0	0 1 10	41 9 1	6 11 6	34 5 6	—	40 17 0	0 12 1	—
1898	0 17 8	101 16 0	0 1 5	102 15 1	60 15 6	40 7 11	—	101 3 5	1 11 8	—
1899	—	50 8 9	0 1 0	50 9 9	31 18 1	15 7 8	—	47 5 9	3 4 0	—
1900	—	103 8 7	0 0 7	103 9 2	34 10 11	65 4 3	0 2 0	99 17 2	3 12 0	—
1901	—	194 13 9	—	194 13 9	69 4 3	102 11 9	0 8 0	172 4 0	22 9 9§	—
1902	—	148 15 5	—	148 15 5	61 16 1	60 3 6	0 9 5	122 9 0	26 6 5	—
1903	—	138 3 0	—	138 3 0	37 16 6	70 0 0	—	107 16 6	30 6 6	—
1904	—	219 13 0	—	219 13 0	94 4 0	90 0 0	—	184 4 0	35 9 0	—
1905	—	200 11 0	—	200 11 0	54 0 1	105 0 0	—	159 0 1	41 10 11	—
1906	—	137 7 0	—	137 7 0	36 2 8	55 0 0	—	91 2 8	46 4 4	—
1907	—	104 14 0	2 10 0	107 4 0	2 5 2	55 0 0	—	57 5 2	49 18 10	—
1908	—	192 2 2	7 10 0	199 12 2	33 12 10	111 18 0	—	145 10 10	54 1 4	—
1909	6 19 11	183 6 7	7 10 0	197 16 6	—	138 6 6	—	138 6 6	59 10 0	—
1910	17 14 10	152 18 10*	84 13 3†	255 6 11	—	190 10 6‡	—	190 10 6	64 16 5	—

* Loans £150 0 0
Interest 2 18 10
£152 18 10

† *I.e.* assets £87 12 1
Less interest 2 18 10
£84 13 3

‡ *I.e.* Deposits £186 0 0
Int. due on deposits. 4 10 6
£190 10 6

§ Includes a gift of £15 6*s.*

IMPORTS OF AGRICULTURAL PRODUCE IN 1911.

The total value of the principal articles of food imported into the United Kingdom in 1911 was £190,712,000, as against £189,418,000 in 1910, £191,505,000 in 1909, £183,957,000 in 1908, £188,353,000 in 1907, £181,604,000 in 1906, and an average of £177,047,000 in the three years 1903–1905. These figures represent the value (cost, insurance, and freight), as declared to the Customs officers at the port of arrival, of the grain and flour, meat and animals for food, butter, cheese, eggs, condensed milk, fruit and vegetables, hops, lard, and margarine, which may be grouped together as agricultural food products in the sense that they compete more or less directly with the home supply.

The increase in value during the past year as compared with 1910 was due to the increased cost, on the whole, of the meat (of all kinds) and dairy produce imported, the total value of the items included under the general heading of meat amounting to £49,737,000, as compared with £48,879,000 in 1910, and the imports of butter, cheese, and eggs together amounting to £39,708,000 in 1911, as compared with £38,599,000 in 1910. On the other hand, the value of grain and grain products was less than in 1910 by £1,500,000.

Cattle and Beef.—The past year has seen a further decline in the number of live cattle imported into the United Kingdom, the number received being 200,397, or about one-third of the imports in 1895. Only two countries (apart from the Channel Islands) participate in this trade, viz., the United States and Canada. An increased export from the United States to this country was accompanied by a decreased export from Canada.

The decline in this direction was more than compensated for by the extensive imports of beef, chiefly chilled and frozen, which amounted in the aggregate to 7,362,434 cwt., the highest figure yet recorded. The imports of fresh beef, however, decreased by nearly 50,000 cwt. The main source of supply of chilled and frozen beef is Argentina, from which country 3,753,140 cwt. of chilled beef, and 2,357,878 cwt. of frozen beef were received. A noticeable feature here is the extension of the chilled beef trade (representing the better

class of meat), which increased to the above figure from 2,710,747 cwt. in the preceding year, whereas the frozen beef imports have remained fairly steady for several years. Another point in connection with the chilled beef trade which is worthy of mention is the continuous decline in the supplies from the United States. In 1911 the very small amount of 169,000 cwt. was received from this source. The imports of frozen beef from Australia, New Zealand, and Uruguay also showed large decreases. The chilled beef from all sources averaged 32*s.* per cwt., while the frozen beef was several shillings lower, viz., 28*s.* per cwt.

The weight of beef represented by the imports of cattle may be estimated at 1,308,000 cwt., which, added to the imports of fresh and refrigerated beef, make the total receipts of meat of this class from abroad in 1911, 8,670,000 cwt., or nearly 21½ lb. per head of the population. In 1910 the figures were 8,432,000 cwt., representing 20¾ lb. per head; in 1909 8,217,000 cwt., or 20⅘ lb. per head; in 1908, 8,115,000 cwt., or 20⅝ lb. per head; in 1907, 8,806,000 cwt., or 22⅓ lb. per head; and in 1906 9,170,000 cwt., which was equal to 23½ lb. per head.

Sheep and Mutton.—The number of live sheep imported rose from 427 in 1910 to 47,673 in 1911, these figures being also larger than the imports in 1909. The quantity of mutton imported on the other hand showed a decrease from 5,406,000 cwt. in 1910 to 5,337,000 cwt. in 1911. Nearly all of it comes in the form of frozen mutton, chiefly from New Zealand (1,981,467 cwt.), Australia (1,291,696 cwt.), and Argentina (1,782,066 cwt.). The quantity received from Australia and New Zealand was less than in the preceding year, but the receipts from Argentina showed an increase of some 400,000 cwt.

The weight of meat represented by the sheep received alive may be estimated at 25,800 cwt., which added to the imports of fresh and refrigerated mutton make the total receipts 5,363,000 cwt., this being equal to 13¼ lb. per head of the population. In the three previous years the total receipts, alive and dead, were 5,406,000 cwt., 4,766,000 cwt., and 4,434,000 cwt. respectively, or about 13⅓ lb., 12 lb., and 11 lb. per head of the population.

The declared value of the fresh mutton was 50*s.* per cwt., or about the same figure as in 1910 and 1909, and 5*s.* less than the values in the three years 1906–8.

Rabbits.—The receipts of fresh rabbits, chiefly from Belgium, amounted to only 57,808 cwt., and the bulk of the supply was composed of frozen rabbits from Australia and New Zealand, the former country sending 394,155 cwt. and the latter 73,703 cwt. The value per cwt. of these frozen rabbits was, however, only about one-third of the value per cwt. of the fresh Continental supply.

IMPORTS of Live and Dead Meat.

Description.	Quantity.		Value.	
	1910.	1911.	1910.	1911.
	Number.	Number.	£	£
Cattle	219,561	200,397	4,027,918	3,776,404
Sheep	427	47,673	754	74,174
Total live animals ...	—	—	4,028,672	3,850,578
	Cwt.	Cwt.		
Beef, fresh & refrigerated	7,015,498	7,362,434	11,745,146	11,136,223
,, salted	87,636	90,303	173,924	171,072
Mutton, fresh and refrigerated	5,405,923	5,337,451	9,802,858	9,588,646
Pork, fresh & refrigerated	479,907	452,932	1,196,797	1,120,674
,, salted	227,191	236,749	304,168	293,163
Bacon	3,863,389	4,868,738	13,391,274	14,463,414
Hams	719,126	954,811	2,526,595	2,927,610
Meat unenumerated—				
Fresh and refrigerated	707,113	726,072	1,310,759	1,315,430
Salted	70,568	88,357	102,686	123,286
Meat, preserved	742,542	946,180	2,514,039	3,036,967
Rabbits, dead	664,190	525,666	837,122	712,600
Total dead meat ...	19,983,083	21,589,693	43,905,368	44,889,175
Poultry and game ...	—	—	944,907	997,324

Bacon.—The imports of bacon in 1911 (4,868,738 cwt.) show a slight rise compared with the decline which was noticeable in 1909 and 1910. Denmark sent 2,122,087 cwt., as compared with 1,794,416 cwt. in 1910 and 1,809,745 cwt. in 1909; and in these three years the United States sent 1,817,835 cwt., 1,306,921 cwt., and 2,189,053 cwt., and Canada 615,807 cwt., 411,935 cwt., and 443,386 cwt.

The declared average value was 59*s.* 5*d.* per cwt. as com-

pared with 69*s.* 4*d.* in 1910, 59*s.* 8*d.* in 1909, and 50*s.* 11*d.* in 1908.

Poultry and Game.—Poultry is chiefly received from Russia, United States, France, and Austria-Hungary, and the total value in 1910 was £918,197, a somewhat substantial increase over the total of the preceding year (£821,292). The value of the imported game was £79,127.

Total Imports of Meat.—Converting the live animals into their equivalent weight of meat and adding the total imports of dead meat of all kinds (excluding poultry and game), it appears that the quantity available, in addition to the home supply, was some 25,787,000 cwt., as compared with 21,401,000 cwt. in 1910, 21,479,000 cwt. in 1909, 22,205,000 cwt. in 1908, and 22,586,600 cwt. in 1907. This was not entirely consumed in this country as there was a small re-export amounting to 325,595 cwt.

The total value credited to the different kinds of live and dead meat, including poultry and game, was £49,737,000, as compared with £48,879,000 in 1910, £47,623,000 in 1909, £49,448,000 in 1908, £51,888,000 in 1907, and £52,026,000 in 1906.

IMPORTS of Dairy Produce, Margarine, and Eggs.

Description.	Quantity.		Value.	
	1910.	1911.	1910.	1911.
	Cwt.	Cwt.	£	£
Butter	4,325,539	4,302,956	24,493,450	24,602,111
Margarine	1,120,812	944,405	2,935,244	2,461,325
Cheese	2,456,340	2,348,322	6,809,876	7,139,942
Milk, condensed ...	1,009,770	1,155,548	1,755,026	2,021,708
	Great hundreds.	Great hundreds.		
Eggs	18,344,137	19,057,895	7,296,145	7,965,609

Butter.—About seven-tenths of the butter supplied to this country from abroad comes from the Continent of Europe, Denmark (1,707,178 cwt.), Russia (638,284 cwt.), France (171,080 cwt.), Sweden (360,357 cwt.), and Holland (104,655 cwt.) being the chief contributors. Almost the whole of the remainder is received from Australia (874,399 cwt.) and New Zealand (276,446 cwt.).

The quantity of butter received was nearly as large as in 1906, when the maximum amount yet recorded was imported; the value, however, in 1911 was 114*s.* 4*d.* per cwt., as compared with 108*s.* 2*d.* in 1906, so that the total value of the foreign and colonial butter imported in the past year was exceptionally high.

Cheese.—The supply of cheese showed a small decrease. More than half the imports come from Canada, but the supplies from this source decreased from 1,607,064 cwt. in 1910 to 1,473,275 cwt. in 1911. A large increase is noticeable in the receipts from the United States.

Eggs.—Up to 1909 the supply of eggs had been declining for several years, but the increase in 1910 was continued in 1911, the large exports from Russia being principally responsible.

IMPORTS of Grain and Flour.

Description.	Quantity.		Value.	
	1910.	1911.	1910.	1911.
	Cwt.	Cwt.	£	£
Wheat	105,222,638	98,109,087	44,160,884	38,927,680
,, meal and flour ...	9,960,491	10,065,132	5,510,905	5,277,043
Barley	18,281,500	24,504,120	5,396,452	8,248,281
Oats	17,495,014	18,275,937	4,823,869	5,391,970
Oatmeal	775,033	835,985	582,225	598,405
Maize	37,021,192	38,602,330	10,294,340	10,713,183
,, meal	461,624	643,810	158,953	224,415
Peas	1,591,111	2,196,094	718,740	1,012,862
Beans	849,082	1,029,131	311,676	375,345
Other corn and meal ...	13,968,382	12,412,380	5,340,339	4,993,671
Total	205,626,067	206,674,006	77,298,383	75,762,855

Grain and Meal.—The imports of wheat showed a decline compared with the 1910 figures, but were greater than in 1909 or in any previous year. The leading sources of supply were Russia (18,106,100 cwt.), India (20,161,518 cwt.), Canada (14,373,700 cwt.), Argentina (14,748,600 cwt.), United States (12,939,229 cwt.), and Australia (13,910,720 cwt.), the imports of wheat from the last-named being now larger than from the United States, and nearly equal to those from Canada.

The receipts of flour were greater than in 1910 owing to

an increase from Canada. The exports of flour from this latter country to the United Kingdom are steadily increasing. The declared value of the total imports under this head was less than in 1910, however.

Barley showed an increase as compared with the previous year. The principal contributors were Russia (6,670,400 cwt.), Turkey (3,856,800 cwt.), Roumania (3,980,800 cwt.), and the United States (3,381,400 cwt.).

Oats amounting to 18,275,937 cwt. were imported in 1911, this figure being slightly higher than in 1910 and 1909. Russia (7,217,100 cwt.) and Argentina (5,597,100 cwt.) were the two chief sources of supply. Germany furnished 1,652,000 cwt., and Canada 1,761,100 cwt., while the imports from the United States were insignificant.

The supply of maize (38,602,330 cwt.), although larger than in 1910, did not reach the 1909 total. Compared with 1910 the imports from Roumania and the United States have doubled, and those from Russia have trebled, while Argentina sent about one-fifth of the supply of 1910, so that the trade in this cereal would seem to fluctuate greatly.

Fruit and Vegetables.—Potatoes were received in smaller quantities than has been the case for many years past. The exports of early potatoes from the Channel Islands were affected, the supply having dropped from 1,318,707 cwt. in 1910 to 1,020,901 cwt. in 1911. The receipts from Germany in 1910 and 1911 were 34,302 cwt. and 336,761 cwt. respectively. The other vegetables imported are mainly onions and tomatoes.

With regard to fresh fruit, there was a falling off in the imports of apricots and peaches, lemons, oranges, plums, and strawberries. There was a fairly large increase in the imports of bananas.

Hops were imported to the extent of 169,184 cwt., as against 176,781 cwt. in 1910, but at a very much higher price.

Wool.—As regards wool, the quantity imported differed but slightly from that of the previous year, and the average price remained about the same, viz., 10¼*d.* per lb., which was the level at which it stood in 1906 and 1907. The bulk of the supply came, as usual, from our own Colonies and Possessions, viz., Australia (323,990,918 lb.), New Zealand

(174,120,629 lb.), British South Africa (101,881,323 lb.), and India (56,595,849 lb.). The total receipts were 795,091,310 lb., as compared with 797,418,403 lb. in 1910.

The re-exports of foreign and Colonial wool were 303,755,000 lb., as against 334,643,000 lb. in 1910, so that the balance of wool (other than home produce) remaining for manufacture in this country was 491,336,000 lb., which was a larger amount than in the five preceding years, viz., 463,929,000 lb. in 1910, 413,326,000 lb. in 1909, 393,594,000 lb. in 1908, and 446,564,000 lb. in 1907.

Soya Beans.—The imports of this article, the residue from which in the form of cake has assumed such importance as a feeding stuff, were 222,657 tons, of which 117,236 tons came from Russia, 102,123 tons from China, 3,278 tons from Japan. The aggregate value was £1,652,283, and the average value per ton about £7 8*s.* 6*d.*

Miscellaneous.—In addition to the agricultural products already mentioned there are some articles of importance which may be referred to as of interest to the agricultural industry. The figures for these are given in the following table :—

MISCELLANEOUS IMPORTS.

Description.	1910.	1911.	1910.	1911.
	cwt.	cwt.	£	£
Wood and Timber	—	—	26,207,329	25,847,077
Tallow and Stearine	2,462,771	2,203,664	4,194,489	3,671,248
Hides :				
Dry	516,896	462,354	1,855,804	1,654,556
Wet	764,155	658,059	2,417,028	2,091,919
Manures :	tons.	tons.		
Basic Slag	16,588	22,266	26,985	37,889
Bones, burnt and unburnt...	44,505	45,876	201,539	226,174
Guano	20,395	34,124	107,958	193,000
Nitrate of Soda	126,498	128,487	1,161,127	1,189,019
Phosphate of Lime and Rock Phosphate... ...	455,593	493,413	722,508	779,706
Oil Seed Cake	317,066	337,425	2,109,604	1,958,309
	cwt.	cwt.		
Seeds, Clover and Grass ...	286,976	233,812	664,170	550,892
Flowers, fresh	—	—	229,798	241,044
	No.	No.		
Horses...	14,674	11,528	530,108	435,323

Prices.—Some indication of the range of prices may be gathered from the average declared value of the different

articles, but only to an approximate extent, as an increased importation of a cheaper quality of any article depresses the average value, although no real change in price may have taken place. With this reservation it may be said that the record for the past year shows, on the whole, a decided decrease in the value of meat of all kinds, especially bacon and hams. There were distinct rises in the price of butter, cheese, and eggs. With regard to grain, the value of wheat and wheat flour declined slightly, while barley and oats increased in value. The figures for some of the principal articles are as follows:—

Description.	1908.	1909.	1910.	1911.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cattle ... ... Head	17 1 11	17 6 5	18 6 11	18 16 10
Sheep ... ... ,,	1 11 1	1 11 10	1 15 4	1 11 1
Beef, fresh & refrigerated Cwt.	1 16 7	1 13 6	1 13 6	1 10 3
Mutton, ,, ,, ,,	1 17 1	1 12 11	1 16 3	1 15 11
Pork, ,, ,, ,,	2 6 6	2 7 10	2 9 11	2 9 6
Bacon ... ... ,,	2 10 11	2 19 8	3 9 4	2 19 5
Hams ... ... ,,	2 10 4	2 15 2	3 10 3	3 1 4
Butter ... ... ,,	5 14 4	5 10 5	5 13 3	5 14 4
Cheese ... ... ,,	2 18 0	2 17 2	2 15 5	3 0 10
Eggs ... Great hundred	0 7 10¾	0 8 2	0 7 11½	0 8 4
Wool ... ... Lb.	0 0 9¼	0 0 9½	0 0 10¼	0 0 10
Wheat ... ... Cwt.	0 8 4¾	0 9 3	0 8 4¾	0 7 11
,, flour ... ... ,,	0 10 11	0 11 6¼	0 11 0¾	0 10 6
Barley ... ... ,,	0 6 9¼	0 6 7½	0 5 10¾	0 6 9
Oats ... ... ,,	0 5 10	0 6 1¼	0 5 6¼	0 5 11
Maize ... ... ,,	0 6 1¾	0 6 2	0 5 6¾	0 5 7

Agricultural Exports in 1911.

The value of the agricultural articles of British production and manufacture exported amounts in the aggregate to a considerable sum, although taken individually they do not usually represent a very extensive trade. The information, available for the past year, is summarised in the next table. The various commodities included under the heading of corn, grain, and flour represent a total of £3,575,908, while meat of all kinds, including live cattle, bacon, hams, poultry, and game, accounts for £1,017,972. Wool from British flocks was exported to the value of £1,631,515, while hides and undressed skins accounted for £1,685,583.

EXPORTS.

Description.		1910.	1911.
		£	£
Grain and flour		3,416,637	3,575,908
Meat (including animals for food)... ...		935,958	1,017,972
Wool...	lb.	36,973,300	30,651,700
	£	1,929,245	1,631,515
Hides and undressed skins... ...	£	1,757,762	1,685,583
Manures	tons	819,966	805,359
	£	4,922,438	5,496,030
Oil-seed cake	tons	175,422	118,665
	£	1,087,183	722,145
Agricultural machinery		1,243,991	1,173,675

Description.		Quantity.		Value.	
		1910.	1911.	1910.	1911.
ANIMALS LIVING—FOR BREEDING :		Number.	Number.	£	£
Cattle	To United States of America	1,701	776	39,154	25,324
	,, Uruguay	179	19	14,911	2,016
	,, Argentine Republic ...	688	243	74,464	20,910
	,, Channel Islands	—	—	—	—
	,, Australia	99	81	6,394	3,903
	,, Canada	212	136	7,361	5,240
	,, Other Countries	599	1,351	28,397	43,003
	Total... ...	3,478	2,606	170,681	100,396
Sheep and Lambs	To Germany	675	475	5,763	4,286
	,, United States of America	1,577	692	9,096	4,326
	,, Uruguay	199	111	2,857	1,191
	,, Argentine Republic ...	738	422	13,935	9,605
	,, Australia	83	72	549	1,262
	,, New Zealand	103	96	3,431	1,955
	,, Canada	3,811	374	20,609	2,283
	,, Other Countries	644	486	6,001	4,753
	Total... ...	7,830	2,728	62,241	29,661
Swine	To Argentine Republic ...	13	—	325	—
	,, Canada	21	22	163	330
	,, Other Countries	825	536	8,652	6,488
	Total... ...	859	558	9,140	6,818
HORSES :					
	To Netherlands	19,957	20,998	223,578	315,031
	,, Belgium	30,206	33,324	390,873	456,981
	,, France	2,353	2,993	115,137	142,128
	,, Other Countries	6,633	6,880	564,350	549,955
	Total... ...	59,149	64,195	1,293,938	1,464,095
ANIMALS OF OTHER KINDS— Not for Food		66,711	91,134	53,529	58,190

Three items of importance, viz., manures, cakes, and agricultural machinery, are included in the table, though they are not agricultural products. In the case of manures, 805,359 tons were sent from these shores, representing a value of £5,496,030; about one-third of this, viz., 291,883 tons, was sulphate of ammonia, while the balance was made up of 159,353 tons of superphosphate, 195,950 tons of basic slag, and 158,173 tons of other kinds of artificial manures.

As regards oil-seed cake, a substantial increase occurred in 1910, but this was not maintained in 1911, when the exports dropped nearly to the figure of 1909.

Perhaps the most interesting item in the export trade, from an agricultural point of view, is that which shows the sales of breeding animals to the Colonies and foreign countries. In the table on p. 843 the particulars are given for the past two years.

The export of cattle showed a marked decrease, owing to the drop in the exports to the United States. The export of sheep was also very much smaller, the decrease in the number sent to Canada and the United States being responsible for this. Horses, however, represent the largest item in this export trade, and the total value in the past year is the largest yet recorded.

Improvement of Indian Wheats for Export.

In a former issue of the JOURNAL (May, 1911, p. 133), mention was made of the work being done at Pusa with the object of improving Indian wheats. Bulletin 22 of the Indian Agricultural Research Institute, Pusa, gives an account of the further progress that has been made in that direction. The researches of the authors—Mr. and Mrs. Albert Howard—have shown that there exist in India types of wheat nearly as suitable for milling and baking purposes as the well-known Manitoba Hard, which, on an average, is worth, in the home market, about five shillings a quarter more than the best British wheats. The superiority of the Canadian wheat lies in its "strength"—a technical term which means that it produces larger and more shapely loaves than other varieties.

For many years the Indian cultivator—under a mistaken notion as to the requirements of this country—has been growing for export a weak wheat which, except for its remarkable dryness, has very little to recommend it to the miller. That the production of this weak wheat has been largely for export is apparent from the fact, ascertained by Mr. and Mrs. Howard, that for his own consumption the native of India much prefers a strong wheat of the Fife or Canadian type. With a view to providing a higher class wheat for export, the Pusa Institute has, for some years, been engaged in collecting stocks of suitable varieties, both by selection and by the new methods of breeding cereals which are being so successfully pursued at Cambridge by Professor Biffen. It appears from the bulletin under notice that success has been attained, so far at least as a portion of India is concerned. Wheats have been produced which, in the climate of Western Bengal, give not only a much higher yield than the native wheats, but also are characterised by great strength, and are therefore likely to command a higher price in the home markets than the wheats hitherto exported. The new wheats have been examined by one of the leading experts in milling in this country, and pronounced to be practically quite as good as the best Canadian.

An interesting feature of the work at Pusa is that it disproves a theory sometimes maintained by experts, viz., that it is impossible to combine high quality with good yield. It has been known for many years that the high quality Canadian wheats cannot be brought, by any system of cultivation, either in Canada or in Britain, to give as high yields as the low quality wheats commonly grown in Britain, and it is sometimes maintained that low quality is a necessary result of the free yielding power of the favourite British wheats. The work at Pusa, however, confirms what has been established at Cambridge—that it is possible, by the scientific methods of breeding associated with the name of Mendel, to combine high quality with good yield. The results obtained last year with Burgoyne's Fife—a new Cambridge wheat—show that it gives a grain equalling the Canadian in milling quality, combined with the cropping capacity of the best British wheats.

During the progress of their investigations, Mr. and Mrs. Howard made an important discovery in connection with the cultivation of wheat in India that may lead to results of the greatest economic importance. After harvesting his crops in March, the Indian cultivator leaves the stubble untouched during the hot dry months of April and May, when the soil becomes so hard that it is hardly practicable to break it up with the native wooden plough. It is not till July, when the rainy season ordinarily begins, that the cultivator starts to prepare the land for the sowing of wheat in October. It has been found at Pusa that if the stubble be broken up immediately after harvest, and cultivated during the dry months, there is a great accession of fertility. By this means it has been found possible to grow crops of 40 bushels per acre without manure, while the cultivators alongside, pursuing their usual methods, were unable to get more than 15 bushels. It appears that we have here a confirmation of the work recently done at Rothamsted by Messrs. Russell and Hutchinson on the increased fertility that follows partial sterilisation of the soil. Between April and June the temperature of the air in Western Bengal often rises above 100° F., and at the same time the heating effect of the sun on the soil is so great that its temperature goes much beyond that figure. The continual stirring of the soil and its exposure to these high temperatures, therefore, may well give results comparable with sterilisation, and thus produce an increase of fertility similar to that observed by the workers at Rothamsted after sterilisation by artificial means.

The Pusa workers still have problems to face: rust is often the cause of serious loss in India, but it is hoped that by pursuing the methods by which Yellow Rust has been conquered at Cambridge, a wheat will be obtained immune to the disease; by similar methods it may be possible to improve the standing power of the straw, a quality in which the new wheats are capable of improvement.

The valuable results that have followed the application of scientific methods to agricultural problems in India encourage the hope that the establishment of Research Institutes with the aid of the Development Grants will lead to equally valuable work being done in this country.

Spraying for Big Bud of Black Currants.

A SMALL experiment was carried out by one of the Board's officers at Harvington, Worcestershire, to test the efficacy of various sprays for combating big bud of black currants. The bushes occupied three-quarters of an acre of ground, but only a small proportion of them were treated. There were two varieties, "Prince of Wales" and "Carter's Champion," all of them affected, the former having an estimated percentage of 60 big buds and the latter of 50.

The bushes were sprayed across the rows so as to eliminate differences solely due to the variety.

Sprays Used.—The sprays used were:—

(1) Lime and sulphur in the dry form at the rate of one part of lime to four of sulphur. Air-slaked lime was used, as ground quicklime in small quantities could not be obtained.

(2) Quassia and soft soap at the rate of 2 lb. of quassia chips, 1 lb. of soft soap, and 10 gallons of water. The quassia chips were boiled for two hours, and then the soft soap was added.

(3) Soft soap alone at the rate of 1 lb. of soft soap to 10 gallons of water.

Plan of the Experiment.—The first three transverse rows were treated with lime and sulphur, the next four were left as control, the next two were sprayed with soft soap, the next four were left as control, and the next $2\frac{1}{2}$ were sprayed with quassia and soft soap. The remaining and larger part of the plantation was left as control.

The two series of intervening control rows were left more to separate any overlapping effects than to act as strict controls.

Dates of Spraying.—On the first spraying, April 20th, the sprays were applied as above. On the second spraying, May 4th, the lime and sulphur was used in the proportion of 1 to 8. On the third spraying, May 25th, pure sulphur was used instead of lime and sulphur.

Results and Notes.—On May 4th immense swarms of mites could be seen outside each big bud. They were also to be found in considerable numbers on the leaves and flowers.

Many living mites were found on the bushes sprayed with quassia and soft soap, though the bushes were sprayed as thoroughly as possible. On May 25th slight scorching was seen on the young leaves of the bushes treated with lime and sulphur. A microscopical examination of big buds from treated bushes and those from control bushes showed but little difference. In each case swarms of mites could be seen at the opening of the buds. Though many of the big buds had dried up there were still plenty from which an active migration was going on.

On June 16th the scorching of the leaves on the "sulphured" bushes was more marked. All the big buds were dried up, but mites were found in the young buds just forming.

On November 4th the plantation was examined as the owner was grubbing the bushes. Sample twigs were taken from the various rows and submitted to microscopical examination. This was necessary, as in November all the buds that contain mites have not yet become "big."

The samples were taken quite indiscriminately, and represented a fair average of the buds. The big buds in each sample were counted with the following results.

	Big Bud.	Normal Bud.	Percentage of Big Bud.
Control	68	102	66·7
Lime and sulphur ...	76	167	45·5
Quassia and soft soap ...	69	135	51·1

The sample from those bushes treated with soft soap only were not counted, as they were obviously no better than the control. Thus the lime and sulphur treatment reduced the amount of disease to two-thirds of the untreated, and the quassia and soft soap to four-fifths.

Occupations of Agricultural Students after leaving College.

Questions are sometimes asked as to the parentage of the agricultural student, and as to what becomes of the student himself. The Board's Report on the Distribution of Grants for Agricultural Education in 1910–11 furnishes some interesting particulars on this point.

The Institutions which are aided by the Board were asked to supply information showing the occupation of the parents

of those pupils who left during the past three years, and the occupation which the pupils themselves now follow. A summary of the returns is given below. The institutions have been arranged in three groups: (1) Agricultural Colleges situated on or near their own farms and providing residential accommodation for a substantial proportion of, or for all, their pupils; (2) University Colleges and other institutions situated in towns and not providing residential accommodation on, or close to, their farms; (3) Farm Schools providing residential accommodation on farms.

Institution.	Total Number of Students Leaving.	Occupation of Parents.			Occupation of Students.		
		Farmers.	Land-owners.	Others.	Farmers.	Land-owners.	Others.
Agricultural Colleges (7) ...	1,064	469	160	435	843	161*	60
University Colleges and other Institutions (5)	384	279	7	98	310	21*	53
Farm Schools (3)	321	221	6	94	294	2	25
Total	1,769	969	173	627	1,447	184*	138

* Include a few teachers, &c.

Of 1,769 pupils for whom full particulars are available, it will be seen that 1,631 are known to have returned to occupations connected with the land, and the great majority are engaged in farming. The "others" number 138, and include a good many who have been lost sight of and may have taken to agriculture. As regards parentage it will be observed that 969 were the sons or daughters of farmers, and a further 173 were connected with the land. It will be remarked that the largest proportion of pupils of non-agricultural origin is to be found in the first group of agricultural colleges shown above, the reason being that residential colleges in the country, with farms attached, are always preferred by non-agriculturists who wish to secure an agricultural training for their children. One College, which would have been included in Group 2 if particulars of the occupations of students had been available, is somewhat exceptional in that the parents of 55 out of 79 pupils were not directly connected with the land.

The Agricultural Department of the University of Cambridge is in a different position from the institutions referred

to above, the students being members of one or other of the Colleges, and their parentage not being known to the Department. The figures supplied by Cambridge have, therefore, not been included in the above returns. In the past three years 231 students have attended the classes provided by the Agricultural Department of this University. Of these 59 are engaged in teaching or research, or are employed in supervising agricultural work in other countries, 26 are landowners or expect to inherit land, 17 are engaged in, or are preparing for, land agency work, 13 are farming. The occupations of the remainder are unknown, but it is probable that many of them expect to inherit land or to become associated with land management.

Preservation of Timber.

The increase in the durability of timber which may be brought about by the use of preservatives is a question of considerable importance in the United States in view of the large annual production of timber in that country, and the subject has engaged the attention of the Forest Service of the Department of Agriculture * since 1902. Although the experiments carried out by the Forest Service were confined to the treatment of poles for telegraph and telephone purposes, many of the results are of interest to the English agriculturist from the point of view of estate management.†

Seasoning of Timber.—The question of seasoning necessarily requires consideration before the use of preservatives is dealt with, since proper seasoning not only prepares timber to receive the preservative treatment, but under certain conditions may be in itself a means of increasing its durability.

Contrary to general opinion, the Forest Service found the shrinkage taking place during the seasoning of poles to be very slight, amounting, in seasoning from green to air-dry condition, to about 0·1 in. or 0·2 in. in the circumference at the butt end, and from 0·15 in. to 0·25 in. in the circumference at the top end of poles. The loss in weight during such seasoning was found to be ordinarily from 16 to 30 per cent.

* U.S. Dept. of Agric., Forest Service, Bull. 84.

† Previous articles on this subject appeared in this *Journal* for May, 1905, p. 77; Sept., 1906, p. 339, and July, 1911, p. 281.

of the original weight, but in the case of yellow pine of the western United States as much as 49 per cent. was lost during seasoning in from three to nine months.

The rate at which wood seasons was found to depend chiefly on climatic conditions, timber cut during spring and summer becoming seasoned, as a rule, much more rapidly than that cut in autumn or winter. Soaking the timber in water, the degree of exposure to the air, and the method of piling the timber also affect the rate of seasoning. Timber which is seasoned rapidly is much more liable to split than that which is seasoned more slowly. In the latter case numerous small splits are formed, but these close again when the wood absorbs moisture, and apparently no detrimental effect is caused. If, however, the wood seasons rapidly, wide and deep splits may be formed, which do not again close, and which not only decrease the strength of the timber, but materially hasten decay by allowing the entrance of insects and fungi.

Application of Preservative with a Brush.—A very simple method of using a preservative is to apply it to the surface of the wood with a brush, but while experiments carried out in this direction by the Forest Service have given good results, this form of treatment does not present a complete solution to the question of timber preservation. It is especially useful, however, where the erection of even the simplest plant would not be justified, as the cost is very low. Creosote was applied hot to poles of chestnut, cedar, and pine, and the average amount of preservative absorbed in each case is shown in the following table:—

Species.	Absorption per Pole.		Length and Diameter of Pole.	Length Treated.
	1 coat.	2 coats.		
	lb.	lb.	ft. in.	ft.
Chestnut	2·6	4·7	30 × 7	6*
White cedar (Southern U.S.) ...	—	4·9	30 × 7	6*
,, ,, (Northern U.S.) ...	3·0	4·4	30 × 7	6*
Red ,, (Western U.S.) ...	—	6·5	40 × 8	8†
Yellow pine (,, ,,) ...	2·4	3·6	40 × 8	7†

* Between 2 ft. and 8 feet from butt end.

† From butt end to height indicated.

In these experiments a penetration of from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. was obtained in seasoned timber. With regard to chestnut, it is stated that in some cases failure of treatment was due to the tendency of the thin sapwood to scale off after exposure to weather, and that better results might have been secured if the sapwood had been shaved off for a few feet above and below the ground-line, so that the preservative would be applied to the more firm heartwood. Applications of carbolineum, creolin and tar were also made with a brush, the absorption of tar by 6 ft. of pole being on an average about 7 lb. Care should be taken in this method to fill all splits formed during seasoning; the preservative should not be applied when the surface of the wood is wet or when very cold. In most cases better results will be obtained by heating the preservative before applying.

Treatment by Immersion.—Immersion in a tank filled with preservative has the advantage, in common with the brush method of application, that the butt end only of poles can be treated, and the expense is avoided of applying the preservative to the portion above ground, which in many cases is sufficiently durable without treatment. The treatment consists in subjecting the timber to successive baths of hot and cold preservatives, these latter being thus driven into the wood by atmospheric pressure. Three methods of procedure are possible:—(1) After the timber has been held in the hot preservative for the required length of time, the heating may cease, and without other change the whole be allowed to cool; (2) the timber may be transferred from the hot liquid to another tank containing cooler preservative; and (3) the preservative may be changed, the hot being drawn off and colder preservative run into the treating tank. The hot bath, as a rule, simply prepares the wood for treatment, absorption taking place, except in the case of very dry and porous woods, during cooling.

The length of time during which the wood must be kept under treatment is dependent among other things on the species and condition of the wood. Thus where the sapwood is narrow and the heartwood difficult of penetration, the treatment should be discontinued after the sapwood has been impregnated; and where the sapwood is wide, the period of

treatment must be arranged so as to avoid an unnecessarily large absorption of preservative.

In the case of porous woods a relatively deep penetration is obtained as compared with the quantity of preservative absorbed by shortening the cold bath and removing the wood while the preservative is still fairly hot. Immersion of chestnut in creosote at a temperature of 231° F. for four hours, and subsequently in cold creosote for two hours, gave relatively good results; while in the case of white cedar (Northern U.S.), little advantage was gained by prolonging the hot bath beyond three or four hours. Good results were obtained by treating red cedar (Western U.S.) for two hours with hot creosote and one hour with cold creosote, although in this case longer treatments sometimes gave better results.

As regards the condition of the wood, it was found that the drier the wood the more readily it may be treated. The absorption of preservative by green timber is small and irregular, and the treatment of unseasoned timber is unsatisfactory in addition, on account of the liability of such wood to split in drying, and thus expose untreated wood to decay. Where it is decided to treat wood not thoroughly seasoned, the temperature of the hot bath of preservative should be high, about 215° F. to 230° F. Experiments carried out by the Forest Service on wood which had been soaked in water before seasoning showed that the wood was not rendered any more permeable to preservative by such treatment.

The Forest Service found that the sapwood of nearly all the common species of wood of the United States could be successfully impregnated by the open-tank process; while, on the other hand, the heartwood of many species could only be successfully treated by artificial pressure. The absorption of creosote by poles of various woods was found to be as follows, 6 ft. of the butt end being treated in each case:—

Species.	Absorption per Pole.	Penetration.
	lb.	in.
Chestnut	21·5	0·3
White Cedar (Northern U.S.) ...	48·4	0·5
Red ,, (Western U.S.) ...	39·5	0·8
Yellow Pine (,, ,,) ...	81·4	3·1
Lodgepole Pine	34·0	1·0

Increased Durability as a Result of Treatment.—The results of the tests indicated that an average increased life of at least three years may be expected from applications of preservatives with a brush. The cost of applying two coats of creosote to 6 ft. of pole (including cost of labour) is estimated on the average at about 10*d.*, and it is computed, therefore, that if the pole has an increased life of one to two years the cost of treatment is amply repaid.

The application of creosote by the tank method will, it is stated, so preserve the butt end of the pole that the life of the pole will be the life of the top, and no data as regards the life of that part of the pole which is above ground are possessed by the Forest Service, since replacements are commonly made because of the failure of the portion immediately above and below the surface. It is estimated, however, that the life of chestnut is increased by six years, white cedar by eight years, red cedar by ten years, yellow pine by seventeen years, and lodgepole pine by fifteen years. The total cost of treatment with creosote by the tank method of 6 ft. of pole is given as follows:—Chestnut, 3*s.* 3*d.*; white cedar, 4*s.* 4*d.*; yellow pine, 6*s.* 9*d.*; red cedar, 5*s.* 7*d.*; lodgepole pine, 5*s.* 2*d.*; and the annual saving per pole, after deducting cost of treatment, is computed as follows:—Chestnut, 7½*d.*; white cedar, 6*d.*; red cedar, 1*s.* 6*d.*; yellow pine, 9*s.*; lodgepole pine, 4*s.* 1*d.* It will be noticed that preservative treatment pays better where the wood has very little natural durability than where it has naturally a large durability; the use of wood for poles, posts, gates, &c., which would otherwise be unsuitable is thus rendered possible.

Grain Growers' Associations in Canada.

AN interesting and instructive account of the way in which grain growers' interests are protected in Canada is given in the number for October, 1911, of the Bulletin of Economic and Social Intelligence issued by the International Institute of Agriculture.

Seed Branch.—The Seed Branch of the Federal Department of Agriculture was formed in 1902 for the purpose of promoting the use of good seed, and preventing, as far as possible, the sale of impure seed to farmers. The work of

the Branch is carried on throughout the whole of Canada by means of meetings, farmers' conferences, seed shows, and competitions, the co-operation of the provincial Departments of Agriculture being in some cases obtained.

One type of competition, started in Western Canada in 1906, which has become very popular, takes the form of a contest between farmers to see who can grow the best crops from specified seed. The judges are officials of the Seed Branch, or experienced farmers. These competitions have proved of considerable educational value by demonstrating on a large scale the better results which can be obtained by the use of selected seed.

The Canadian Seed Growers' Association.—This is one of the most important organisations of its kind in Canada. It receives a money grant and is also assisted in other ways by the Department of Agriculture. It aims at encouraging, by combined effort, the use and production on Canadian farms of good seed only. Grain grown under the supervision of the Association for a certain time can be registered, either as pure seed or simply as registered seed, an examination of a sample being made in each case.

There are also two important associations in Ontario for the cultivation of cereals for seed, viz., the Ontario Agricultural and Experimental Union and the Ontario Corn Growers' Association.

The Ontario Agricultural and Experimental Union.—This Union was founded in 1880 with the object of keeping past pupils of the Ontario Agricultural College in touch with the staff, and also with the work of the College. In this way the opinions and experience of farmers have been brought to the notice of the staff of the College, while the farmers have been able to benefit by the experiments carried out at the College.

The first combined experiments were carried out by the members of the Union on their own farms in 1886, and many new and improved varieties of cereals, &c., are now cultivated as a result of the work thus begun.

The method adopted is to distribute each spring a scheme of experiments for the year. The tests are usually of a simple character, such as the testing of the productive quality of different varieties of grain, roots, &c. The necessary seed is

supplied free of charge to any farmer undertaking to carry out the test, and to report the results to the Union. The work has been fruitful in increasing a knowledge of the results of agricultural investigations, and in bringing to the notice of farmers new and improved varieties of seed, &c.

The Ontario Corn Growers' Association.—This Association was formed in 1908 to promote better methods of selection and choice of seed among farmers. Its exhibitions are an increasing success, and it aims at making the province produce its own seed instead of using seed from outside sources. The Association has 600 members, who are aiding its work by experiments. It is in receipt of a grant of about £50 per annum.

The Saskatchewan Grain Growers' Association.—The Saskatchewan Grain Growers' Association may be taken as typical of the large grain growers' associations in Saskatchewan, Manitoba, and Alberta. It safeguards growers' interests in every possible way, and encourages or opposes legislative action which appears likely to affect these interests.

The Association consists of local societies with a central executive, and holds an annual general meeting, at which the local societies are represented by delegates. At the meeting in February, 1911, resolutions were passed with regard to insurance against hail, the lowering of railway freight rates and of import duties, and the construction of a railroad to Hudson Bay.

The Grain Growers' Grain Company.—This Company was formed in 1906 by associations of grain growers with a view to obtaining the best possible market for their produce. Its formation was the direct result of an inquiry which was held to investigate the complaints of farmers that they were at the mercy of a small number of buyers backed up by the railways.

The Company is recognised by the Government of Manitoba as a joint stock co-operative society with shares of 25 dollars (about £5); only farmers can be shareholders, and no one can hold more than four shares. Each shareholder has only one vote. It was originally intended to follow the co-operative principle as regards the profit-sharing, but this was objected to as being contrary to the laws under which the Company was

registered. This scheme was therefore abandoned. The number of farmers possessing shares is at present 8,500.

The Company handled in 1906–7 2½ million bushels of grain, and paid a dividend of 8 per cent. In 1909–10 these figures had risen to 16½ millions, and the profit secured was £19,000, out of which a dividend of 15 per cent. was paid, and a sum of £10,000 added to the reserve fund.

The great portion of the corn is sold to exporters in Eastern Canada and in the Eastern United States. The Company has succeeded beyond expectations in securing improved market conditions and obtaining for farmers the best prices possible.

SUMMARY OF AGRICULTURAL EXPERIMENTS.*

FIELD CROPS.

A Russian Method of Corn Cultivation (*Landw. Jahrb., Band XLI., Heft* 2).—The method of corn cultivation advocated by M. Demtschinsky in Russia was first brought prominently to the notice of German agriculturists in 1908, and since the autumn of that year numerous and extensive experiments have been carried out in various parts of Germany by agricultural schools, chambers of agriculture, and responsible individuals. The experiments were at first carried out exactly on the lines laid down by M. Demtschinsky, but later on modifications were introduced as regards certain details in some cases. It will be remembered† that M. Demtschinsky's plan consists in (*a*) transplanting and deep-setting, or (*b*) deep-setting the plant in the same position, or (*c*) earthing up the plants in the rows.

A report by Dr. A. Einecke, of the Agricultural Chemical Experiment Station at Berlin, is given in the above publication, and contains an account of the experiments which have been carried out in Germany. The results, although differing very much as regards certain points, may be said to be fairly unanimous in condemning transplantation and deep-setting of cereals, principally because no sufficiently increased yield is obtained to compensate for the additional expenditure on wages on account of the increased labour which is necessary. The requisite labour was found to be in marked contrast to that reckoned by M. Demtschinsky. The latter gave 16 to 20 days' labour (one man) as sufficient for one acre, whereas

* A summary of all reports on agricultural experiments and investigations recently received is given each month. The Board are anxious to obtain for inclusion copies of reports on inquiries, whether carried out by agricultural colleges, societies, or private persons.

† See *Journal*, Dec., 1909, p. 740; Feb., 1911, p. 932; July, 1911, p. 330.

in the experiments under notice the extra labour that had to be employed varied from 53 days in Pomerania to 120 days per acre in Wiesbaden. In one instance the transplantation and deep-setting could not very well be carried out on account of the heavy soil. In Posen, the dry weather which is usually prevalent in May and June was held to render the transplantation of spring cereals impossible. The longer period of vegetation under M. Demtschinsky's system would not render the system advisable in unfavourable climates.

As regards the effect of earthing up the plants in the rows, the results seem to have been extremely favourable in most cases to the development of the plants, and the latter are usually prevented by this method from being "laid" by bad weather. Little extra labour would seem to be involved, a special machine being used for sowing.

The effect on the various cereals may be noticed. The results, both of earthing up and transplanting, were favourable on winter rye on sandy and clay soils; winter wheat in general was much less favourably influenced than rye. Experiments on spring rye did not meet with success. Earthing up and transplanting were attended with good results in two experiments on spring barley. The effect on oats varied so much that no definite statement is possible.

There is no doubt that as regards individual plants the results of the Demtschinsky method of cultivation are extremely favourable. The ears are longer and the production of grain per plant greater than from ordinary methods of cultivation.

A point which has not been decided in these experiments is as to whether dibbling would not on strong soils give as good results as the methods of transplanting and deep-setting advocated. Further, although this Russian system cannot be said to have been a success financially, it has drawn the attention of German agriculturists to the possible value of deeper ploughing, and sowing the seed earlier, farther apart, and in smaller quantity. The system may also be of use from the point of view of plant breeding.

The same publication contains an account of another series of experiments which were carried out in the experimental fields of the Royal Würtemberg Agricultural High School at Hohenheim in 1908–9 on rye, and in 1909–10 on wheat, rye, barley, and oats. The results may be summarised as follows:—

The Demtschinsky method caused an extraordinarily good development of the plants, and this is to be ascribed principally to the thin seeding. The development was greatest in the case of winter barley, with winter rye and winter wheat next in order, and smallest in the case of spring barley.

The ripening of the corn was delayed from 3 to 10 days, but earthing up and deep-setting led to greater uniformity in the development of the plants and in the ripeness of the grain.

Where the seeds and plants suffered from pests (*e.g.*, snails, frit-fly, &c.) the damage was greater where the Demtschinsky method was employed than where the ordinary method of cultivation was followed. The former system was very effective in preventing the corn being "laid" by bad weather.

Earthing up, transplanting, and deep-setting caused a very large

increase in the yield of corn and straw from the individual plant as compared with the yield from ordinary methods of cultivation, especially in the case of winter barley. There was no noticeable difference in the increases brought about by each of these three methods (viz., thin seeding, transplanting, and earthing up) separately.

As regards yield per acre, it may be said that earthing up and transplanting decreased the yield per acre, but increased the size and weight of individual grains.

It is concluded that transplanting cannot be undertaken by practical agriculturists on account of the large amount of labour necessary. Earthing up is perhaps practicable on a large scale, but leads to no higher yields than ordinary methods.

Experiments were carried out at the same time in regard to another system of cultivation which has also attracted attention in Germany. This is known as the Zehetmayr system, and appears to consist in drilling the seed in a special way. Briefly no very great practical advantages were found to result from this system in these experiments over and above those obtained from good ordinary cultivation.

Varieties of Oats (*Bedfordshire C.C. Agric. Educ. Com., Rept. on Wheat and Oat Plots,* 1911).—The following varieties of oats gave the heaviest crops :—

	Five years previous to 1911. Bush.	1911. Bush.
White Horse (Webb) ...	48	46
Waverley (Garton)... ...	44	43
Abundance (Garton) ...	43	50
Newmarket (Webb) ...	41	51
Record (Garton) ...	...Not grown	50

Newmarket and Abundance, which were better than the others in quality and weight, are considered to be well adapted for a general crop. The proportion of grain and husk was ascertained, and a high percentage of grain was found usually to accompany high weight.

LIVE STOCK AND FEEDING STUFFS.

Cattle Feeding (*Jour. of the Dept. of Agric. and Tech. Instruction for Ireland, October,* 1911).—Imported feeding stuffs were compared with home-grown foods for cattle. The experiment was carried out at two centres; at the first, two lots each of seven cattle were used for ten weeks, and at the second centre two lots each of ten cattle were tested for eight weeks. One lot at each centre was fed on a mixture of imported foods consisting of one part (by weight) of maize and two parts of undecorticated cotton cake, and the second lot was given a mixture of home-grown foods consisting of one part of wheatmeal, one and a half parts of barley meal, and two parts of ground oats. At the beginning of the experiment the animals received 3 lb. per head daily of the concentrated foods; this was later increased to 4 lb., and finally to 5 lb. The cattle were also put out to pasture.

The total live weight increase was 27 cwt. from the 17 animals fed on imported foods, and 24¾ cwt. from the 17 animals fed on home-grown foods. Reckoning the increases at 33*s.* per cwt., the profit

from the imported feeding stuffs over the home-grown foods works out at £3 11*s.* 7*d.* To this amount, however, must be added the difference in the cost of the foods (imported foods cost £10 13*s.* 4*d.* and home-grown £13 16*s.* 3*d.*), and the greater manurial value of the cotton cake and maize.

DAIRYING.

Churnability of Cream (*Jour. Agric. Sci., Vol. iv., Pt. 2, October,* 1911).—In an article, by Messrs. Cooper, Nuttall, and Freak, of the Cooper Research Laboratory, dealing with the fat globules of milk, a number of investigations are described which were undertaken with the object of explaining the variations in the behaviour of cream in churning. It appears that the cream of various breeds—and even the cream of individual cows—shows a persistent difference in behaviour as regards the time required for churning and the amount of fat recovered in the form of butter. It appears that cream in which the average size of the globules is large gives the best results for butter making, whereas for cheese making the smaller globules give better results. The authors describe the ingenious apparatus they have devised for carrying out these investigations on the "churnability" of milk. They are unable to announce a solution of the various problems to which the subject gives rise, but it is hoped that a more extended series of experiments will yield valuable results.

WEEDS AND PLANT PESTS.

Tumour and Canker in Potatoes (*Jour. Roy. Hort. Soc., December,* 1911).—This article, by Mr. A. S. Horne, B.Sc., F.G.S., gives the history of *Chrysophlyctis endobiotica* and *Spongospora solani,* together with an account of the symptoms of the two diseases. With regard to the latter an experiment at Durham is described in which the seed was derived from several different known sources, and the potatoes planted in the experimental rows were carefully selected. The crop was found to be uniformly infected, and it is contended that it is extremely improbable that the disease in this case was introduced by infected seed. The addition of lime to the soil brought about an increase in the amount of disease. It is concluded from the experiment at Durham and from some experiments carried out near Edinburgh and in Aberdeenshire, that *Spongospora* may be present in the soil of a particular field or farm, but the disease may not manifest itself to any extent.

DISEASES OF ANIMALS.

Loss of Efficiency in Arsenic Dipping Fluids (*Jour. Agric. Sci., Vol. iv., Pt. 2, October,* 1911).—A paper dealing with the loss of efficiency observed in certain alkaline arsenite dipping fluids is contributed from the Cooper Research Laboratory. In certain warm climates, where, owing to the prevalence of tick-borne diseases, it is necessary to dip cattle periodically, the fluid used contains sodium arsenite as its principal ingredient, and under the influence of the other ingredients an oxidation of the arsenite sets in which results after a time in the bath losing its efficiency.

The authors have succeeded in proving that this oxidation is mainly due to the presence of tar products in the bath, and that wood tar (*e.g.*, Stockholm tar) in particular favours rapid oxidation.

This result, it is suggested, points to the need of periodic official analysis in all countries where dipping of cattle is enforced by law.

Tuberculosis in Cattle (*Census and Statistics Monthly, October,* 1911).—Practical open-air experiments, which lasted from December, 1905, to February, 1909, were carried out under the direction of the Veterinary Director-General of the Canadian Department of Agriculture. The objects of the experiments were three: first, to ascertain the effect of open-air treatment on the diseased cattle themselves; secondly, to ascertain to what extent healthy cattle kept in contact with diseased cattle under open-air conditions were subject to infection; and, thirdly, to ascertain what percentage of healthy calves it was possible to rear from diseased cows kept without any precautions under open-air conditions. The original herd under experiment at Ottawa consisted of 43 animals, but some were slaughtered and additions were made, which, it is admitted, rather detracted from the value of the experiments. Altogether 52 calves entered into the experiments, and of these 29 escaped infection, 21 contracted tuberculosis, and two cases were doubtful. Approximately the proportions were 60 per cent. healthy and 40 per cent. diseased. The proportion of healthy calves, viz., 60 per cent., is at first sight, according to Dr. Rutherford, somewhat discouraging; but when it is remembered that with one exception all the cows on which they were reared were affected with tuberculosis, that one had a tuberculous udder, and that a number of others were open and clinical cases, the matter assumes a somewhat different aspect. It is highly improbable, he thinks, that such a large percentage of healthy calves could have been obtained from a herd of the same kind under ordinary stable conditions. He states further that the data obtained indicate that open-air life is highly beneficial to tuberculous cattle, and that the danger of transmission to adult cattle kept in contact under these conditions is relatively slight, whilst, on the other hand, the percentage of healthy calves raised by the diseased cows is, as was to be expected, relatively small.

HORTICULTURE.

Pollination of Apples (*Jour. Roy. Hort. Soc., December,* 1911).—It being accepted that many varieties of apples require pollen from flowers of another variety in order to produce fruit, it becomes of importance to know the time of flowering of different varieties, since the chances of successful pollination will be greater if varieties flowering at the same time are intermixed.

This article gives the results of observations taken at the Royal Horticultural Society's Garden at Wisley as to the average order of flowering of varieties of apples in the four years 1908–11. The earliest date of full bloom of the earliest variety (Red Astrachan) at Wisley was April 21st., and the latest date of full bloom of the latest variety (Royal Jubilee) was May 23rd, and the period of full bloom varied from 18 to 35 days. The dates of flowering of a few of the varieties may be given for purposes of comparison. The number

of days that elapsed between the flowering of Red Astrachan (the earliest) and Early Peach was 4⅝ days; Duchess of Oldenburgh, 5⅜ days; Keswick Codlin, 5¾ days; Stirling Castle, 6¼ days; Early Rivers, 7¼ days; Lord Suffield and Ribston Pippin, 8 days; Cox's Orange Pippin and Lord Grosvenor, 10⅝ days; Duke of Devonshire, Early Victoria, and Beauty of Bath, 10¾ days; Worcester Pearmain and Lord Derby, 11¾ days; Ecklinville Seedling, 11⅞ days; Lane's Prince Albert, 13½ days; Potts's Seedling, 14⅛ days; Bramley's Seedling, 14⅜ days; Cox's Pomona, 14¾ days; Mr. Gladstone, 15 days; Thomas Rivers, 15¼ days; Surprise, 16⅞ days; Sandringham, 17¾ days; and Royal Jubilee, 18⅞ days.

The results at Wisley are compared with results obtained at Sawbridgeworth, Woburn, Wye, Herefordshire, Victoria (Australia), and at stations in the United States, and it is evident that apples retain their characteristic earlier or later flowering propensities regardless of differences of locality.

MISCELLANEOUS EXPERIMENTS.

Electrical Treatment of Crops (*Leaflet, Miss E. C. Dudgeon, Lincluden House, Dumfries*).—The following is a brief account of some experiments carried out by Miss E. C. Dudgeon in 1911 on the growth of potatoes with electric treatment, by means of the Lodge-Newman high-tension electric discharge apparatus. The field used was one on the farm of Lincluden Mains, near Dumfries, tenanted by Mr. Cameron, and the portion reserved for experimental purposes was about 8 acres, which, from the date of ploughing till the planting of the seed tubers, was treated all over in precisely the same manner. The land was practically level, having only one or two slight undulations; the soil varied slightly, some portions being loamy, while others were gravelly, but as these inequalities were distributed over the whole field, care was taken in dividing the plots to include equal portions of each variety in both experimental and control areas.

The field was ploughed in February, after which it was given a dressing of 6 cwt. to the acre of a special potato manure, and at the time of putting in the seed tubers, about 25 cart loads of farmyard manure per acre were spread between the drills.

Owing to a spell of wet weather it was not possible to commence planting till the third week in April, and for the first week after planting had been completed rain fell for several days. From May 4th to June 15th the weather was bright and dry; after that date rain fell for several days, when dry weather again set in and continued up to the date of lifting the crops.

The electric discharge was applied daily from May 1st till August 18th, averaging during that time four hours per day. The hours for putting on the discharge were regulated by weather conditions—on dull days it was applied both morning and afternoon; when it was warm, with bright sunshine, for two, three, or four hours in the evening. The discharge was applied for a total of 413 hours.

The varieties of potatoes planted were Ringleader, Windsor Castle, Golden Wonder, and Great Scot.

Owing to applying too late for seed tubers of the Ringleader, which

variety Miss Dudgeon was anxious to have for trial, she was only able to obtain the third-grade size, which in many cases were little larger than an ordinary marble.

From the commencement of the application of the discharge a distinct difference was observed between the two plots, the crops under the electrified wires being, from the commencement of growth up to the time of ripening, distinctly in advance of those outside the influence of the charged wires. The tubers were ready for lifting quite a week earlier; also the greater height of the haulms and luxuriance of leaf-growth were very marked.

The following table gives the weights per acre of the crops lifted in the electrified and control plots :—

	Not electrified. tons	cwt.	Electrified. tons	cwt.	Increase. tons	cwt.
Ringleader ...	5	17	8	1	2	4
Windsor Castle	9	18	11	15	1	17
Golden Wonder	8	2	8	15		13
Great Scot ...	10	6	11	16	1	10

The cost of applying the electric discharge was £5 19*s.* 6*d.*, comprising petrol, £1 6*s.*; lubricating oil, 6*s.*; and depreciation at 10 per cent. on apparatus (costing £175) for three months, £4 7*s.* 6*d.* The same expense would, however, have covered the cost of electrifying an area of 15 acres instead of the 8 acres treated in the experiment.

Utilisation of Atmospheric Electricity in Plant Cultivation (*Jour. d'Agric. Pratique, September 29th,* 1910).—An apparatus which has been used during a number of years at Angers for fixing atmospheric electricity with very good results is described in this publication, and the results obtained with a number of crops are given.

Experimental Error in Field Trials (*Jour. of Agric. Science, Vol. IV., Part 2, October,* 1911).—The question of the experimental error in agricultural investigations continues to attract attention. It was discussed at some length by some of the leading research workers in the Supplement to the December issue of this *Journal,* and the matter is carried to a higher stage of refinement in an article by Messrs. Hall and Mercer in the above periodical. An analysis of the sources of variation in field experiments shows that they may be divided into two categories :—(*a*) Variation in the climatic or seasonal conditions under which the experiments are made; (*b*) the natural fluctuation of the plant under observation under the influences of casual environmental conditions, such as small differences of soil, situation, or cultural treatment. The first varies from year to year, while the second may affect crops growing in the same field under the same seasonal conditions. The authors lay down that the limits of the error due to the first class cannot be evaluated on the assumption that they obey any law, but they show, on a consideration of experiments carried out at Rothamsted, that errors of the second class obey a definite law, and, consequently, can be predicted. They are of opinion that errors of the latter class can be best evaded by scattering the plots receiving the same treatment about the area under experiment, and as a suitable system they recommend that each unit of comparison

(*i.e.*, each plot of the same variety, or each plot receiving the same manurial treatment, &c.) should consist of *five* sub-plots, each of one-fortieth of an acre, systematically distributed over the area under observation.

Destruction of Field Mice (*Praktische Blätter für Pflanzenbau und Pflanzenschutz, September–October,* 1911).—An account has already been given in this *Journal* (January, 1911, p. 861) of the havoc wrought by a serious plague of field mice which occurred in Bavaria in 1910. A report by the Royal Agricultural and Botanical Institute at Münich urges upon agriculturists the necessity of taking active measures against mice before the plague becomes so serious as to render the success of remedial measures doubtful.

The experience gained in combating the plague in 1910 went to show that all the methods adopted have their advantages and disadvantages, and that conditions which are favourable to the employment of one method are unsuitable for the employment of another.

With regard to preventive measures, the best method recommended for general use against field mice is fumigation with carbon bisulphide. Old pieces of sacking should be dipped in the liquid and pushed as far as possible into the burrow with a stick, and the gas given off asphyxiates the mice. A method, however, that does the work more economically, quickly, and completely, besides eliminating all danger to the operator, is to use an apparatus specially invented for the purpose and sold throughout Germany. Where carbon bisulphide is employed without apparatus, great care has to be exercised on account of its inflammability, and it must be stored so that the proximity of any burning or smouldering material is impossible.

An older method than the above consists in laying poisons in drains or in wooden boxes open at the sides, covered with straw, and placed in the fields. The renewal of the poison from time to time prevents any increase in the numbers of field mice.

The foregoing preventive measures can be carried out by the individual, but when an extensive plague of field mice occurs, combined action only can be expected to meet with success. Rat poisons and viruses seem to be preferred where combined action is necessary, especially the former, on account of their simplicity and the rapidity with which they take effect. Apart from their dearness, however, all poisons have the disadvantage that they are liable to be eaten by animals other than mice, and care must therefore be taken that domestic animals, or wild animals which destroy mice, do not get at the poison. Corn poisoned with strychnine is mostly used, but phosphorus is also often employed. In the latter case straws are smeared with the preparation and thrust into the burrows. The mice in passing out rub against the straw and die through licking the poison from their bodies. Barium salts, especially barium carbonate, have proved very effective, and have the additional merit of being cheap.

Rat virus is recommended where measures are to be adopted on a large scale for the destruction of field mice. The most favourable time to use the virus is in the early spring, as the mice are then least resistant to the bacilli, and in the absence of other food are compelled to eat that which has been treated with the virus. Virus

may be used also in late autumn, from the middle of October onwards. The laying of the poison or virus should take place preferably in early morning or in the evening, and in fine weather. Rainy weather injures the effectiveness of the materials.

FORESTRY.

Experiments with Scots Pine Seed from Various Sources (*Prof. W. Somerville, Quarterly Jour. of Forestry, October,* 1911).—In 1907 Prof. Somerville started a small experiment with Scots pines to test the influence of the latitude and elevation at which the seed was gathered. Samples of 100 seeds gathered in different countries and situations were sown in pots at Oxford on May 10th, and the results examined after intervals of one, three, and twenty-two months from sowing. After being measured and weighed the seedlings were put out in nursery lines and left till they were four years old. In the following table are shown the number of seeds out of each 100 which had germinated a month after sowing, and the number of seedlings surviving at four years, with their heights and weights.

District where Seed was Gathered.	Percentage Germination after 1 month.	Seedlings four years old.		
		Number.	Average Height.	Weight per 100.
			In.	Lb.
1. Switzerland ... ... 5,600 ft.	10	4	3·2	0·93
2. ,, ... 4,600 ,,	15	15	7·1	6·66
3. ,, ... 1,250 ,,	70	34	8·0	8·55
4. Alsace ... ... 430 ,,	69	29	7·5	5·71
5. East Prussia .. Lat. 54°	50	17	5·4	2·94
6. Central France ... Lat. 45°	55	15	4·0	2·50
7. Southern Sweden... Lat. 57°	54	15	6·6	5·62
8. Northern ,, ... Lat. 62°	38	13	2·5	0·84
9. Brodie, Scotland... 100 ft.	11	2	2·0	0·22
10. Switzerland ... ... 5,780 ,,	13	All died off in the first winter.		
11. ,, ... 2,650 ,,	48			

It will be seen that Nos. 3, 4, 5, and 7 gave very much better results than some of the others. The experiment was not designed to show the best sources from which British planters may draw supplies of seed or seedlings, for seed which suits one locality may be quite unsuitable for another. It is clear, however, that the suitability of the origin of seed for planting in any particular locality has an enormous influence upon the fate of silvicultural operations, and that much more information upon the subject is required.

Dr. Somerville points out that if a landowner, desiring to establish plantations of Scots pine under such conditions as prevail at Oxford, had happened to lay in a stock of the seed which had been gathered at a high elevation in Switzerland, or from a high latitude in Sweden, or from a low elevation in the north-east of Scotland, he would probably have obtained results that must have absolutely prevented success in his operations.

OFFICIAL NOTICES AND CIRCULARS.

The Board have issued the following circular letter, dated December 7th, 1911, to Local Authorities in Great Britain under the Diseases of Animals Acts, 1894 to 1911 :—

Anthrax. Reports as to Samples sent for Examination.

SIR,—I am directed by the Board of Agriculture and Fisheries to advert to their Circular Letter (No. A $\frac{19c}{C}$) of September 24th, 1910, as to the Anthrax Order of 1910, and to acquaint you, for the information of your Local Authority, that in connection with the examination at the Board's Laboratory of samples forwarded there in pursuance of Article 5 (4) of the Order, it is found to be desirable that the reports as to such samples should also be sent by the Veterinary Inspector, or Veterinary Surgeon employed by the Local Authority, direct to the Laboratory, instead of to this office as indicated in the footnote to the specimen form of Report in Appendix III. to the Circular Letter above referred to. The Board would be obliged, therefore, if your Local Authority would be so good as to arrange accordingly.

The reports should be addressed to—

THE CHIEF VETERINARY OFFICER,
Laboratory of the Board of Agriculture and Fisheries,
Alperton Lodge,
Wembley, Middlesex.

The postage of communications addressed to the Laboratory must, in order to comply with the Postal Regulations, be prepaid by the sender.

I am, &c.,
T. H. ELLIOTT,
Secretary.

The Board have recently published the following new leaflets :— No. 241, The Construction of Cow Houses; No. 251, Common Weeds—I.; No. 254, The Composition of Seaweed and its Use as Manure; No. 255, The Workmen's Compensation Act, 1906; No. 257, The International Agricultural Institute : Its Objects and its Publications; and No. 259, Swift Moths.

Recent Leaflets.

New editions of the following leaflets have been issued, the information in a number of them having been revised :—

No. 7.—*Autumn Catch Crops and Fodder Supply.*
No. 42.—*The Short-Eared Owl.*
No. 50.—*Water Wagtails, or "Dish-washers."*
No. 57.—*External Parasites of Poultry.*
No. 80.—*The Use of Artificial Manures.*
No. 105.—*Wart Disease (Black Scab) of Potatoes.*
No. 143.—*The Turnip Mud-Beetle.*
No. 177.—*Precautions against Accidents caused by Farm Machinery.* —Information with regard to the prevention of boiler explosions has now been included.

No. 205.—*The Apple Sawfly.*
No. 226.—*Broom-Rape.*—An improved illustration is given.

Results of Service Seasons of Thoroughbred Stallions awarded King's Premiums.

The Board of Agriculture and Fisheries desire to make public the results of the Service Seasons of the thoroughbred stallions to which King's Premiums were awarded by the Board in March last. The total number of mares served by the fifty stallions was 3,245, an average of 65 mares a stallion. The average payment by the Board to the owner of a King's Premium Stallion was £177, and the maximum payment £224. In addition, the stallion owner is entitled to receive from mare owners £2 for each mare served, and will also receive from the Board 12*s.* 6*d.* for each foal dropped. The total earnings of a King's Premium Stallion for an average season will amount approximately to £300, and for an exceptionally good season to £400.

MISCELLANEOUS NOTES.

Importation of Animals, Fodder, and Some Animal Products into Australia.—The importation of animals, &c., into the Commonwealth of Australia is governed by the Quarantine Act of 1908. Provisional regulations under the Act have been recently issued (Statutory Rules, 1911, No. 121). The following is a summary of the provisions as far as animals imported from the United Kingdom are concerned.

Importation Regulations.

Not less than seven days' notice of the arrival of any animal must be given by the importer to the Chief Quarantine Officer of the State.

The following declarations, &c., must be forwarded with the animals by the owner or consignor of any imported animals, whether horses, asses, mules, cattle, sheep, goats, swine, or dogs, and must be delivered to the Chief Quarantine Officer prior to the landing of the animals :—

(1) A declaration from the owner certifying—

(*a*) That the animal has been free from disease during the six months next preceding shipment, and, in the case of *dogs,* that the animal has been located in the country during these six months.

(*b*) That it has not been in contact with any animal suffering from disease during the six months next preceding shipment.

(*c*) In the case of any *horse, ass,* or *mule,* that it has not, except as required under (2), been tested with mallein during the thirty days next preceding shipment; in the case of *cattle* that it has not, except as required under (2), been tested with tuberculin during the two months next preceding shipment; in the case of any *sheep* or *goat* that it has been dipped by thorough immersion in an effective scab-destroying preparation within the fourteen days next preceding shipment (the exact nature of the dipping preparation used must be stated in the declaration).

(2) A certificate by a qualified veterinary surgeon as to a mallein test in the case of any *horse, ass,* or *mule,* or a tuberculin test in the

case of *cattle*. The certificate must, *inter alia*, state the date on which the test was applied.

(3) A certificate of general health from an approved veterinary surgeon at the port of shipment, who, in the case of horses, asses, mules, and cattle, must, unless he himself has applied the mallein or tuberculin test, also endorse the mallein or tuberculin test certificate to the effect that after due inquiry he has no reason to doubt its correctness. In the case of sheep, goats, and dogs the veterinary surgeon at the port of shipment must endorse the owner's declaration to the effect that after due inquiry he has no reason to doubt its correctness.

Cattle and Sheep for Slaughter.—In the case of cattle and sheep imported for immediate slaughter a certificate from a Government veterinary inspector of the country of origin is required to the effect that the animals have been inspected immediately prior to shipment, and are free from disease.

Animals for Scientific or Exhibition Purposes.—Notice of intention to introduce wild or undomesticated animals for scientific or exhibition purposes into a State must be given to the Chief Quarantine Officer of the State, and a permit to introduce must be obtained. The permit must be handed to the master of the ship prior to the embarkation of the animal, and delivered by him to the Quarantine Officer at the port of entry. The notice and permit may be given by cablegram. In addition, a declaration is required as under 1 (*a*) and 1 (*b*) above, which must also set forth the location and environment of the animal during the six months next preceding shipment. A certificate from an approved veterinary surgeon at the port of shipment is also required.

Performing Animals.—In the case of circus or other performing animals of the several kinds permitted to be imported, the declarations, certificates, notices, and permits are those required in respect to the same kind of animal generally.

Quarantine.—The period of quarantine, which is passed at a quarantine station, dating from the time of removal from the vessel, is 14 days for *horses, asses,* and *mules,* 40 days for *cattle,* 14 days for *swine,* 30 days for *sheep* and *goats,* 60 days for *dogs,* and 90 days for *wild and undomesticated animals*. Examination and treatment in quarantine is to be as the Chief Quarantine Officer directs. It will include the mallein test for horses, asses, and mules, and the tuberculin test for cattle. Sheep and goats may be sheared and will be dipped at least twice. No release from quarantine will be issued until the animals have been certified to be in good health. Charges are made for the maintenance, examination, and treatment of animals in quarantine, and must be defrayed by the owner or consignee, who may be required to make a deposit, varying according to the animal, with the Chief Quarantine Officer.

Fodder.—The importation of fodder is subject to the permission of the Minister of Agriculture, and to the conditions (1) that the importer is to give not less than two days' notice of arrival of the fodder, and (2) that the fodder is to be landed in quarantine at an approved place, and treated as prescribed or as directed by the Chief Quarantine Officer.

Hides and Skins.—The owner or consignor must forward with any

hide or skin a declaration made in the country of origin before a magistrate to the effect that such hide or skin was not derived from any animal which had suffered from or died from anthrax or similar disease, and that it has been effectively dry salted, wet salted, or arsenically dressed. This declaration must be certified to by a Government officer of the country of origin, to the effect that to the best of his knowledge the declaration is true and correct.

Hides and skins are not allowed to be landed without a permit, and on receipt of the permit they must be removed to an approved tannery or other approved place for treatment as prescribed or as directed by the Chief Quarantine Officer.

Wool and Hair.—Notice of intention to import must be given by the importer, and the permit of the Minister of Agriculture obtained. On landing the wool and hair is to be removed to a quarantine station for treatment as prescribed or as directed by the Chief Quarantine Officer.

Bones and Animal Manure.—The regulations provide for notice of arrival being given by the importer and for treatment in quarantine. Bones may only be imported through Sydney, Melbourne, Geelong, Brisbane, Rockhampton, Townsville, Port Adelaide, Fremantle, and Hobart.

Importation of Live Stock into Ceylon.—Regulations of October 7th, 1911, issued under the Contagious Disease (Animals) Ordinance of 1909, provide that every person importing horses, asses, or mules into the island from oversea ports shall, wherever possible, give to the principal officer of Customs at least 24 hours' notice of the arrival of such animals, and shall produce a certificate of inspection by a qualified veterinary surgeon describing such animals and certifying that they were free from disease immediately before shipment.

Upon receipt of the above notice, the principal officer of Customs shall cause such animals to be inspected by a duly authorised veterinary Inspector, who shall report to the Customs the official result of his inspection, or in his discretion he may authorise the discharge of the said animals from the ship.

No animals may be discharged from the ship without the authority of the Inspector or be removed from the Customs' premises without the permission of the principal officer of Customs. (*Board of Trade Journal,* November 16th, 1911.)

Importation of Seeds into Newfoundland.—Act No. 19 of 1911 provides that no person may import, for the purpose of sale, any seeds of cereals, grasses, clovers, forage plants, field roots, or garden vegetable crops without first obtaining a licence for such purpose.

Such licences may be granted by the Minister of Agriculture and Mines to such persons as shall have received the requisite certificate of the Inspector appointed under the Act, entitling the holder thereof to import for sale seeds of all kinds. Such licences shall be in force for one year from the date thereof, and may be issued at any time.

The Act is *not* applicable to seeds imported by persons for their own use and not for sale, or by agricultural societies for distribution among the members thereof, or to any seed which may be imported

for the purpose of being sold for food and not for seeding. (*Board of Trade Journal,* November 2nd, 1911.)

Importation of Hides and Skins into Roumania.—The *Moniteur Commercial Roumain* of October 1st, contains regulations prohibiting absolutely the importation into Roumania of unprepared hides and skins, and requiring compliance with various provisions in the case of prepared hides and skins. (*Board of Trade Journal,* November 9th, 1911.)

Notes on Agriculture Abroad.

Opening for the Export of Tinned Butter.—The attention of buttermakers in this country is drawn to the fact that opportunities may exist for the establishment of a small trade in tinned butter in countries where dairy cattle are not usually kept or where butter rapidly becomes rancid owing to the climate. In Greece, for instance, where the butter of the country is made almost entirely from ewes' milk, small tins of butter containing from ¼ lb. to ½ lb. can be obtained, and are sold at about 5*s.* 10*d.* a lb. The Board have made inquiry through the Board of Trade as to whether there is any special disadvantage or difficulty connected with the trade in butter of this class in Greece which would account for the high prices ruling there, but have not been able to discover any such disadvantage or difficulty. The import duty is about £2 11*s.* 2*d.* per cwt.

Sale of Seeds in Canada.—The Seed Control Act (Canada) of 1911 repeals the Acts of 1906 and 1910 on this subject, which were summarised in this *Journal* for January, 1906, and November, 1910. The present Act prohibits the sale, for the purpose of seeding, of any seeds of cereals, flax, grasses, clovers, or forage plants, except timothy, alsike, red clover, and alfalfa unless they are free from any seeds of noxious weeds, or unless every package, &c., containing such seeds, or a label securely attached thereto, is plainly and indelibly marked with the full name and address of the seller, with the name of the kinds of seed, and with the common names of the noxious weeds the seeds of which are present in the seed sold.

In the case of the sale, for the purposes of seeding, of seeds of timothy, red clover, alsike, or alfalfa, or any mixture containing these seeds, the packages, &c., containing the seeds, or labels securely attached thereto, must be plainly marked with the full name and address of the seller, and the name of the kinds of seed, with a designation of the grade of the seed, *i.e.,* Extra No. 1; No. 1; No. 2; or No. 3. The grade Extra No. 1 must mean that the seeds are pure as to kind, clean, sound, plump, of good colour, free from the seeds of any noxious weeds, and contain not more than thirty seeds of all kinds of weeds, including other useless or harmful plants, per ounce of the seed so marked. Grade No. 1 must mean that the seeds are clean, sound, reasonably plump, of good colour, contain not more than five noxious weed seeds per ounce of timothy, red clover, or alfalfa, or ten of them per ounce of alsike seed, and not more than one hundred seeds of all kinds of weeds per ounce of the seed so marked. Grade No. 2 must mean that the seeds are reasonably clean, sound, contain not more than twenty noxious weed seeds per ounce

of timothy, red clover, or alfalfa, or forty of them per ounce of alsike seed, and not more than two hundred seeds of all kinds of weeds per ounce of the seed. Grade No. 3 must mean that the seeds contain not more than eighty seeds of noxious weeds per ounce of timothy, red clover, or alfalfa, or one hundred and sixty of them per ounce of alsike seed, and not more than four hundred seeds of all kinds of weeds per ounce of the seed. The sale of seeds, for seeding purposes, of timothy, alsike, red clover, or alfalfa containing a greater proportion of impurities than that specified for Grade No. 3 is prohibited.

The sale, for seeding purposes, of seeds of cereals, flax, grasses, clovers, forage plants, field roots, or garden vegetable crops, which are not capable of germinating in the proportion of two-thirds of the percentage standard of vitality for good seed of the kind is prohibited unless every package, &c., containing such seed, or a label securely attached thereto is plainly and indelibly marked with the name of the kind of seed, and the percentage of the seeds that are capable of germination.

The sale of "papered seeds," *i.e.*, sealed packets of garden seeds, including both vegetable and flower seeds, is prohibited unless the same are marked with the year in which the packet was filled, and such seeds must not be afterwards used to mix with any other seeds that may be offered for sale for seeding.

Budget of the French Ministry of Agriculture, 1911.—The amount provided for Agriculture in the French Budget of 1911 is £2,151,247, or £164,900 more than in 1910. The main items are :—

	£
Salary of Minister and staff	47,040
Grants in aid to farmers and subventions to agriculture	121,000
Bounties given for the cultivation of—	
Silkworms	200,000
Olives	80,000
Hemp	91,000
Indemnities for the destruction of diseased animals ...	64,000
Stud farms	277,125
Encouragement of horse breeding	53,040
Preservation of forests, dunes, watercourses, and hill land	190,140
Employés in State forests, &c.	230,080

The bounty of £80,000 for the cultivation of olives is a new item this year. (*F.O. Repts., Annual Series,* No. 4806.)

Proposals for the Destruction of the Warble Fly in Germany.—Various estimates have been made of the damage caused in Germany by the Warble Fly, and the loss to tanners and butchers alone has been placed at £300,000 to £400,000 per annum. In an article by Dr. Karl Möller,* President of the German Union of Tanners, it is stated that the general public suffers more than either the farmer, tanner, or butcher, as, on account of the dearness of leather, damaged pieces are not thrown away, but the defects are concealed for the time being, to reappear after the boots, shoes, saddlery, &c., into which the leather has been manufactured, have been subjected to a little wear.

* Massregeln zür Bekämpfung der Dasselschäden (*Mitteilungen der Deut. Landw. Gesell.*, June 3rd, 1911).

It is suggested by Dr. Möller that the relatively small cost which would be incurred by the destruction of the flies should be wholly or partly borne by the State. The method of destruction proposed consists in the appointment of experts whose duty it should be to free cattle from flies in certain districts during specified months of the year. Experiments with smearing animals with different preparations have not given good results in Germany, but the satisfactory extraction of the maggots is not an easy matter for the average farmer. Squeezing the maggots out of the ripe warbles with the hand is considered the most effective method of treatment, but there is some difficulty in determining the proper time for this treatment. If undertaken before the warbles are properly ripe, it is ineffective and causes much pain to the animals. The discharge of matter from the warble is usually indicative of ripeness, but, even so, experience is needed to determine the proper time of treatment. This experience is not easily acquired by farmers, and the appointment of persons who would devote themselves entirely to the work is therefore advocated.

Measures similar to those just outlined have been adopted in Denmark with excellent results (see *Journal,* November, 1910, p. 659). The cost of treatment in that country is less than ½*d.* per head of cattle, but it is computed that, for the first year at any rate, in Germany an expenditure of 4*d.* per head of cattle would have to be incurred. The need for this larger amount is based on the assumption that very thorough measures would at first have to be taken if any degree of success is to be realised, but the cost would decrease in succeeding years.

Demand for Artificial Manures in Japan.—In consequence of the increasing requirements of Europe and the United States for soy bean cake as a feeding stuff, there have been marked decreases in the imports of the cake into Japan, where it is used as a manure. Partly as a result of this there is at the present time an increasing demand for sulphate of ammonia, nitrate of soda, and phosphates in Japan. The imports of sulphate of ammonia in 1910 were 69,000 tons, valued at £925,500, as compared with 46,000 tons in 1909 and 66,000 tons in 1908. This manure is obtained almost entirely from the United Kingdom, 57,000 tons of the 69,000 tons imported in 1910 coming from this country. It is stated that sulphate of ammonia will always be required for wet land cultivation, *i.e.,* for such crops as rice and the rush used for making matting.

Nitrate of soda, on the other hand, being essentially a manure for dry land cultivation is used in Japan for mulberry, tobacco, tea, wheat, barley, rye, indigo, and vegetables. The imports of this manure rose from 6,000 tons in 1909 to 14,000 tons in 1910. Phosphates increased in the same period from 70,000 tons to 167,000 tons.

The total import of manures is valued at £3,869,000, and the home production of artificial fertilisers at £3,023,000. It is estimated that if the value of the other manures used is added the total annual consumption would probably amount to £17,000,000. (*F.O. Reports, Annual Series,* No. 4768.)

Opening for Compressed Fodder in India.—According to an article in the *Agricultural Journal of India* for October, 1911, there is a great

lack of fodder in many parts of the Bombay Deccan. Even in an ordinary year fodder in these districts is so scarce that hardly any is stored. In other parts it is usually plentiful, but its bulk prevents transportation, and it therefore appears that a good opening exists for compressed fodder that is easily portable, and can be kept for a long time.

Prevention of Adulteration of Fertilisers in Russia.—A Bill for the prevention of the adulteration of artificial manures in Russia, which is at present under consideration, proposes to prohibit the sale of manure containing less than a given percentage of its proper constituents or more than a certain percentage of impurities. The Bill also provides for the establishment of experimental stations and laboratories in various districts for the purpose of testing fertilisers. (*Board of Trade Journal,* December 14th, 1911.)

Demand for Chemical Manures in Egypt.—H.M. Consul at Alexandria (Mr. E. H. Mulock) reports that in 1910 there was an increase in the imports of chemical manures, due to their increasing demand for intensive cultivation, chiefly of agricultural crops, and to some extent (in Alexandria only) of vegetables and fruit. A total of 35,559 tons was imported into Egypt in 1910, of which 50 per cent. came from Belgium, 33 per cent. from Chile, and 14 per cent. from the United Kingdom. This total included 30,505 tons of nitrate of soda, 3,318 tons of superphosphates, 1,660 tons of sulphate of ammonia, and 76 tons of miscellaneous manures. There is also an increasing demand for potassic manures for use on poor lands.

The British share of the chemical manures imported in 1910 is four times as much as in 1909, and constitutes one-seventh of a total that has increased by 66 per cent.

Up to the present manures have been allowed to be imported duty free, but from January, 1912, this privilege will cease, and duty will be levied as on other imports (*F.O. Reports, Annual Series*, No. 4726).

Notes on the Weather in December.

The weather underwent frequent changes in the *first* week, November 27th to December 2nd, and while its general character was unsettled, all parts of the country experienced some days with little or no rain. In the south-east and north-west of England the weather was dry, "moderate" falls of rain being recorded elsewhere. Temperature differed little from the average over Great Britain generally. Bright sunshine was less than the normal in the eastern and central parts of England, and above it elsewhere.

The general condition was again extremely unsettled in the *second* week, rain falling very frequently, with, however, considerable intervals of bright sunshine. Temperature was below the normal generally, but equal to it in the Midland Counties, England E. and S.E., and Scotland N. Rainfall exceeded the average except in Scotland N., the excess being large in most districts; heavy falls occurred on December 6th and 8th over a very large area in the west and north. "Abundant" or "very abundant" sunshine was recorded during the week over the whole country.

Rain was almost of daily occurrence during the *third* week, and in the western and northern districts fine intervals were usually very brief. The falls over the whole week were "heavy" or "very heavy," except in Scotland N. Warmth was uniformly "moderate." Sunshine varied considerably in different districts, in Scotland N. and E. it was "scanty," in England E. and the Midland Counties it was "abundant," while in other districts it was "moderate."

Daily rain was again experienced over most of the country in the *fourth* week. In the south-east of England the aggregate rainfall was four and a half times greater than the normal. Temperature was much above the average, "unusual" or "very unusual" warmth being everywhere recorded. Bright sunshine exceeded the average only in Scotland N. and E., and was below it elsewhere.

In the *fifth* week, December 24th–30th, the weather was less disturbed generally than during the preceding week, but more or less rain was experienced on most days. The temperature was still high, warmth being "unusual" in every district except Scotland N. and E. Rainfall varied from "moderate" to "very heavy" in different districts, and sunshine was either "moderate" or "scanty" everywhere.

Crop Conditions in Great Britain on January 1st.

The Crop Reporters of the Board, in reporting on the state of the crops and the agricultural conditions on January 1st, state that the continuous rains during December generally hindered work in the fields; but as operations were well advanced at the beginning of the month, farm work is, with few exceptions, forward for the season. Wheat and beans are everywhere a good plant, healthy, and very promising. Over 80 per cent. of the whole area at present intended for wheat has already been sown, the proportion being larger in England, whereas in Wales and Scotland it does not amount to more than about three-fourths. As compared with January 1st, 1911, the area already sown would appear to be quite 7 per cent. greater in England and Wales, but in Scotland it is perhaps 4 per cent. less. The increased area would seem to be chiefly in the south-west and west midlands.

The very hot summer has left its mark upon the "seeds," which are, south of the Trent at least, weak and patchy, clovers having especially suffered, while in many districts considerable areas have been ploughed up. In the north of England the position is less unsatisfactory, and in Scotland there are some very good fields.

Special inquiries have been made as to the marketing of the potato crop, and, although the replies indicate much diversity in adjoining districts, it appears that about half the English crop has already been sold, while in Scotland the proportion is barely one-third. In many cases, however, the potatoes, although sold, have not yet been delivered.

The mild wet weather of the month has allowed some late crops of turnips and swedes, particularly the latter, and chiefly in the north, to make further growth, but generally they are scarce, small, and of poor quality, except in Scotland.

The condition of ewes is generally said to be fair considering the scarcity of food. The lack of turnips and the wet weather are, how-

ever, very general causes of poor condition. Lambing has commenced among the Dorset Horn flocks; in Hampshire reports are so far satisfactory, but farther west there are numerous complaints of losses of lambs, or shortness of milk, or losses of ewes. Other stock have done fairly well, and the very mild month, with consequent growth of grass, has allowed of their being pastured in the fields much longer than usual, thus economising to some extent the supplies of other food.

Notes on Crop Prospects Abroad.

THE Bulletin of Agricultural Statistics for December, 1911, issued by the International Institute of Agriculture, shows the production of the cereal crops last year from information received up to December 19th. The countries in the Northern Hemisphere for which it is possible to give an approximate estimate of the area and production of wheat, rye, barley, and oats, are as follows:—Europe (excluding Portugal, Norway, Sweden, and countries south of the Danube other than Bulgaria); Canada, the United States, India, Japan, Asiatic Russia, Algeria, Egypt, Tunis. The final returns of area and production in Germany are now substituted for the preliminary figures previously published, which referred to Prussia only. Preliminary figures for Austria and Bulgaria have been added, and important revisions have also been made in the figures for Russia and the United States, which are referred to below.

Wheat.—The production of wheat in the 73 governments of Russia is now estimated to be 63,669,000 qr., a decrease of 14,222,000 qr. on the estimates given in the November Bulletin. In the United States the production of wheat is now estimated at 77,645,000 qr., a reduction of 4,271,000 qr. on the last estimate given. The figures for the area have also been revised considerably as a result of the census taken in April, 1910. The total production for all the above-mentioned countries this month is 391,515,000 qr., as compared with 397,104,000 qr. in 1910, or a decrease of 1·4 per cent.; while the total area harvested exceeds that of 1910 by 3·9 per cent.

Rye.—The production of rye in the United States is now estimated to be 3,863,000 qr., an increase of 293,000 qr. on the estimate in the previous Bulletin. The total production of rye in all the countries specified (excluding Great Britain, India, Japan, Egypt, and Tunis), is 180,702,000 qr., as compared with 190,679,000 qr. last year, a decrease of 5·2 per cent. The area harvested is greater than that of 1910 by 1·5 per cent.

Barley.—It is now estimated that Russia in Europe will produce 48,137,000 qr., as compared with the estimate last month of 51,074,000 qr., and the estimate for the United States has been increased from 17,509,000 qr. to 19,223,000 qr. on the month.

The total production in the above-named countries, with the omission of India, is estimated to be 163,551,000 qr., being about the same as that obtained in 1910. The area harvested is about 1 per cent. less than in 1910.

Oats.—The estimated total production of European Russia has been reduced by 5,310,000 qr. to 81,300,000 qr., and that of the United States increased from 89,579,000 qr. to 94,568,000 qr. on the month.

The total production in the above-named countries, with the omission of India and Egypt, is estimated at 383,579,000 qr., or 9·1 per cent. less than in 1910, although the area harvested is slightly in excess of that in 1910.

Maize.—The production of maize in European Russia is now estimated at 9,556,000 qr., as against the estimate of 7,084,000 qr. given in the November Bulletin. The production in the United States is now estimated at 295,257,000 qr., against 323,810,000 qr. in the previous month. The total production in 1911 in Austria, Bulgaria, Spain, Hungary (including Croatia and Slavonia), Italy, Roumania, Russian Empire, Switzerland, Canada, United States, Japan, Algeria, Egypt, and Tunis, amounts to 370,840,000 qr., being a decrease of 10·5 per cent. on the production obtained in 1910.

The following information is given concerning crops in the Southern Hemisphere :—

Argentina.—The areas which will probably be harvested in 1911–12 are: wheat, 17,035,590 acres; oats, 2,546,570 acres. The areas harvested in 1910–11 were: wheat, 12,233,910 acres, and oats 1,605,500 acres.

Chile.—The production for the year 1911–12 is estimated at 4,821,000 qr. of wheat and 1,901,000 qr. of barley, being increases of 6·9 per cent. and nearly 670 per cent. respectively, as compared with the production of 1910–11.

Australia.—The production of wheat estimated for 1911–12 is 9,417,000 qr. or 20·8 per cent. less than in 1910–11.

New Zealand.—The prospects of wheat, barley, and maize on December 1st were average, and of oats 20 per cent. above average.

The information received by the Institute up to December 19th concerning the sowing of autumn cereals in the Northern Hemisphere was to the effect that winter sowing was almost finished, and the crops were, in general, germinating well, and development was uniform.

Argentina.—A special cable from Buenos Ayres on Thursday, December 28th last, stated that weather conditions during the week had been in the main unfavourable; the new shipping season would be late in starting. Reports from all districts of damage done by recent abnormal weather were numerous and authentic; all estimates of exportable surplus were being reduced—some substantially so. (*Corn Trade News*, December 29th, 1911.)

India.—The preliminary official estimate for the Punjab, United Provinces, Bombay and Sind, Bengal, Central Provinces, and North West Frontier, gives the area sown to wheat as 24,168,000 acres, as against 22,522,000 acres in the preliminary estimate last year, and 24,918,000 acres the final figure. The condition is described as excellent in the United Provinces, good in the Punjab, Bengal, and Central India, and fair in Bombay and the North-West Frontier. (*Beerbohm's Evening Corn Trade List*, December 29th, 1911.)

Sugar-Beet.—The official returns published in the Bulletin of the International Agricultural Institute give the total production in Prussia, Belgium, Bulgaria, Denmark, France, Hungary (not including Croatia and Slavonia), Italy, Roumania, Russian Empire, Servia, and Canada, as 27,920,000 tons, a reduction of 24·3 per cent. on the production of

1910. The total area harvested in the above-named countries was 4,068,000 acres, as against 3,730,000 acres last year, an increase of 9·1 per cent.

Potato Crops Abroad.—The production of potatoes in Italy, the Russian Empire, and the United States in 1911 and 1910, as reported by H.M. Ambassador at Rome, H.M. Consul-General at Odessa, and in the *Crop Reporter* respectively, is shown in the following statement :—

	1911. Thousands of Tons.	1910. Thousands of Tons.
Italy	1,665	1,514
Russia (73 Governments)	31,380	35,602
	Thousands of Bushels.	Thousands of Bushels.
United States	273,170	328,511

Census of Live Stock in the United States.—H.M. Ambassador at Washington has forwarded the results (subject to revision) of the Live Stock Census taken on April 15th, 1910. In the following table the results are compared with those of the Census taken in 1900. The figures embrace animals, whether on farms or not, in the continental United States.

	1910 (April 15).	1900 (June 1).	Increase (+) or decrease (−).	
			Actual.	Per cent.
CATTLE	63,104,573	69,335,832	−6,231,259	− 9·0
Dairy Cows	21,751,183	18,108,666	+3,642,517	+20·1
Other Cattle	41,353,390	51,227,166	−9,873,776	19·3
HORSES and COLTS ...	22,813,850	21,203,901	+1,609,949	+ 7·6
SWINE	59,288,592	64,686,155	−5,397,563	− 8·3
SHEEP AND LAMBS ...	52,183,923	61,735,014	−9,551,091	−15·5

In making comparisons the different time of the year at which the two Censuses were taken must be borne in mind. It is pointed out that the decreases of certain classes of cattle, of colts, swine, and spring lambs are largely or wholly due to the changed date of enumeration. Thus only 7,965,646 spring calves were returned in 1910, as compared with 15,577,728 in 1900; a part of this difference is, however, due to the fact that in 1900 "calves" included all cattle less than one year old, but in 1910 only calves born in 1910. Again, only 12,681,170 spring lambs were returned in 1910, as compared with 21,702,447 in 1900.

Prevalence of Animal Diseases on the Continent.

The following statement shows that, according to the information in the possession of the Board on January 1st, 1912, certain diseases of animals existed in the countries specified :—

Austria (for the period December 20th—27th).

Anthrax, Blackleg, Foot-and-Mouth Disease (total of 30,973 Höfe now infected), Glanders and Farcy, Rabies, Sheep Scab, Swine Erysipelas, Swine Fever.

Belgium (*for the period November 1st—15th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (816 "foyers" in 325 "communes"), Rabies.

Bulgaria (*for the period December 7th—14th*).
Glanders and Farcy, Rabies, Sheep-pox, Swine Fever.

Denmark (*month of October*).
Anthrax, Foot-and-Mouth Disease (45 cases), Glanders, Swine Erysipelas.

France (*month of October*).
Anthrax, Blackleg, Foot-and-Mouth Disease (14,115 "étables" in 2,748 "communes"), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Germany (*for the period December 1st—15th*).
Foot-and-Mouth Disease (15,456 infected places in 4,962 parishes), Glanders and Farcy, Swine Fever.

Holland (*month of November*).
Anthrax, Foot-and-Mouth Disease (1,089 outbreaks in 11 provinces), Swine Erysipelas.

Hungary (*for the period December 6th—13th*).
Anthrax, Foot-and-Mouth Disease (total of 11,711 "cours" now infected), Glanders and Farcy, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Swine Fever.

Italy (*for the period November 13th—19th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (270 new cases entailing 5,695 animals), Glanders and Farcy, Rabies, Sheep-scab, Swine Fever.

Montenegro (*for the period October 1st—15th*).
Foot-and-Mouth Disease (96 "étables" infected in 13 "communes"), Glanders.

Norway (*month of November*).
Anthrax, Blackleg.

Roumania (*for the period November 23rd—30th*).
Anthrax, Foot-and-Mouth Disease, Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Russia (*month of June*).
Anthrax, Foot-and-Mouth Disease (422,045 cases in 5,635 "communes"), Glanders and Farcy, Pleuro-pneumonia, Rabies, Sheep-pox, Swine Erysipelas, Swine Fever.

Servia (*for the period December 2nd—9th*).
Rabies, Swine Fever.

Spain (*month of October*).
Anthrax, Blackleg, Dourine, Foot-and-Mouth Disease (56,549 animals), Pleuro-pneumonia, Rabies, Sheep-pox, Sheep-scab, Swine Erysipelas, Tuberculosis.

Sweden (*month of November*).
Anthrax, Blackleg, Foot-and-Mouth Disease (2 "étables"), Swine Fever.

Switzerland (*for the period December 11th—17th*).
Anthrax, Blackleg, Foot-and-Mouth Disease (176 "étables" entailing 1,823 animals, of which 26 "étables" were declared during the period), Swine Fever.

Agricultural Labour in England during December.

The Board of Agriculture and Fisheries have been furnished by the Board of Trade with the following report, based on returns from correspondents in various districts, on the demand for agricultural labour in November :—

Labourers outside the regular farm staff lost a good deal of time during December on account of wet weather. The demand for such men was also affected by the forward state of farm work and by seasonal slackness, and the supply was consequently in excess of requirements in many districts. Some scarcity of men for permanent situations was reported in several parts of the Southern and South-Western Counties.

Northern Counties.—Rain caused some loss of time to extra labourers in most districts. There was a limited demand for such men for threshing, turnip pulling, manure carting, hedging, draining, &c. The supply of men was reported as more than equal to the demand in a number of Rural Districts, including those of Longtown (*Cumberland*), West Ward (*Westmorland*), and Bridlington, Great Ouseburn, Howden, Pickering, Pocklington, and Selby (*Yorkshire*).

Midland Counties.—Extra men were chiefly required for such work as threshing, carting manure, storing roots, and hedging. The demand, however, was generally only moderate, partly on account of the forward state of farm work, and in nearly all the counties in this group a surplus of extra men was reported in one or more Rural Districts, the counties in which a surplus appeared to be most general being *Staffordshire, Worcestershire,* and *Oxfordshire.* Loss of time on account of rain was reported in most districts, particularly in the case of threshers.

Eastern Counties.—The partial failure of the root crops was again accountable for a reduced demand for extra labourers, particularly in *Norfolk* and *Suffolk,* where a surplus of men was reported in a number of districts; some surplus was also reported in the Chesterton (*Cambridgeshire*), Bourne (*Lincolnshire*), and Braintree (*Essex*) Rural Districts. Any considerable loss of time through rain was not general, though reported in some districts, particularly in *Suffolk* and *Essex.*

Southern and South-Western Counties.—Outdoor work was considerably affected by rain in all these counties during December, and extra men were generally in irregular employment in consequence. A certain amount of work was provided for such men at threshing, carting manure, hedging, and ditching, draining, and on the root crops, but the demand, apart from the effect of wet weather, was generally only moderate, and a surplus of men was reported in several districts in *Surrey, Hampshire,* and *Wiltshire,* and also in the Faversham and Hollingbourne (*Kent*), Chailey (*Sussex*), and Wareham and Purbeck (*Dorset*) Rural Districts. Men for hedging and ditching were wanted in the Hereford Rural District, and there was some scarcity of men for permanent situations in the Godstone (*Surrey*), Chailey and Petworth (*Sussex*), Highworth and Swindon (*Wiltshire*), and Dursley, Northleach, Stow-on-the-Wold, and Thornbury (*Gloucestershire*), and West Penwith (*Cornwall*) Rural Districts.

THE CORN MARKETS IN DECEMBER.

C. KAINS-JACKSON.

Wheat.—The average price continued for English at 2*s.* to 3*s.* above the level of a twelvemonth previous. December, 1911, wound up therefore with appreciably stronger markets than did December, 1910. Russian wheat was 3*s.* to 3*s.* 6*d.* dearer on the year, American winter 2*s.* dearer, and spring 4*s.* dearer. This interesting difference in the rise of the American sorts in England is but a faint reflection of the difference in America. New York's last market of 1911 gave prices equalling 34*s.* per 480 lb. for winter, and 41*s.* for spring wheat. It was to be noted with regard to these quotations, that while the values in England and America respectively encouraged winter wheat shipments for 1912, they appeared to prohibit supplies of the spring wheat which the English miller particularly appreciates. About 42*s.* was the best price made for the finest Manitoba and other "best Dominion" wheat, the year ending with 41*s.* to 41*s.* 6*d.* ruling. This was 5*s.* advance from the period when Canadian crop results were most favourably reported upon.

The supply of wheat on passage at the end of December was fully half a million quarters larger than at the end of 1910, the increase being in Californian and Australian, two sorts of better colour than strength. The natural anticipation, of course, is that for the first two months of 1912 strong red wheat will be a more buoyant market than weak or starchy white. The warehouses at fifteen chief ports hold just on two million quarters, a clear million less than a year ago. This makes wholly for a rising market, and it is not thought likely that farmers will check the rise by heavy deliveries. They are believed to have sold about 600,000 qr. more of the new wheat in the first four months of the cereal year than they did last season, and this being so, the reserves of home produce are not likely to be so large as to encourage fuller market supply than usual.

The shipments of December were 1,472,000 qr. from North America (including a large percentage of Canadian), 242,000 qr. from South America, 1,193,000 qr. from Russia, 1,183,000 qr. from Europe S.E., 493,000 qr. from India, and 324,000 qr. from Australasia. The Antipodean harvests were assumed at Christmas to be about equal in total to those a year previously, the increased yields in Argentina balancing the decrease in Australasia.

Flour.—The mean price of Town Households at Mark Lane's 150 markets within the year 1911 was 26*s.* 4*d.* per sack, against 27*s.* 5*d.* for 1910. But Minnesota First Bakers' Flour, the strong American sort largely used for mixing with English flour in making an ordinary loaf, closed as it opened, the year, at 25*s.* 6*d.* to 26*s.* per sack. Finest American in 1911 never went lower than 29*s.*, and closed at 31*s.* 6*d.* London top-price on December 30th was 32*s.* for cash. Hungarian fancy flour was making 39*s.*, Australian ordinary, 25*s.* 6*d.*, and common country roller whites 24*s.* or thereabouts. The prices commanded in December by the by-products of the mill were more favourable to the miller than to the owner of live stock.

December shipments from North America were 498,000 sacks, and

the supply on passage on the 30th was 138,000 sacks, against 252,000 and 258,000 at the end of the years 1910 and 1909. There was decided firmness in flour as 1911 passed away, but the small sale of bread during the mild weather told on bakers' inquiry, and made stores a little difficult to move. Fortunately for their holders they are in very moderate compass.

Barley.—Some remarkably high averages have been recorded at different markets, mostly in counties facing the North Sea, and particularly in Kent. The mean price of barley for the whole kingdom has been satisfactory, and so large a proportion of the new English has graded 432 to 448 lb. that the 400 lb. sorts of foreign have met with a specially brisk inquiry. Value for Russian advanced before Christmas to 26*s.* per qr., and just before the month closed 26*s.* 3*d.* was paid. The demand for Indian barley was good, 26*s.* to 27*s.* being offered.

Barley shipments were 15,000 qr. from California, 1,694,000 qr. from Russia, 572,000 qr. from Europe S.E., and 50,000 qr. from India. The supply on passage on the 30th was 340,000 qr., a good deal below the average. Russia and Europe S.E. combined shipped from August 1st to December 30th about the same total as in the like period of 1910, but an increased Continental demand has reduced the quantity for which English bills of lading are held.

Oats.—Rather slow trade combined with advancing prices has constituted a somewhat unusual combination. The shipments of the month were 648,000 qr. from Russia, and 170,000 qr. from Europe S.E., but the practical cessation of shipments from the New World and the failure of Australasia, South Africa, and Scandinavia as sources of supply caused the total on passage to shrink to a small figure. Russian oats at 19*s.*, La Plata at 19*s.* 6*d.*, and fine Canadian at 22*s.* 6*d.* were, as December closed, decidedly expensive articles on their feeding value. Argentina was offering to ship new crop direct to London at 16*s.* 9*d.* cost, freight, and insurance, but these supplies will not be with us in any quantity before February.

Maize.—Business was very much in holders' favour just before Christmas, and the report by the International Agricultural Institute of a 10·5 per cent. falling off in world production, which was issued on the 28th, caused many merchants to ask 31*s.* 6*d.* per qr. for their stores. America meanwhile is hurrying to get the good prices ruling, and is offering to ship new crop, cost freight and insurance, at 29*s.* per qr. direct to English ports. The price is for steamers to start within a week of order. For February delivery 27*s.* to 28*s.* is bid, and 27*s.* for March. Meanwhile a speculative trade with Buenos Ayres has sprung up, and the new La Plata crop, which will not be dry and fit to ship before the end of May, is offered for June export at 25*s.* to 25*s.* 3*d.* per qr. Maize looks like being a very speculative market for at least the first half of the year on which we have entered.

Shipments in December were 223,000 qr. from North America, 273,000 from Russia, and 1,082,000 from Europe S.E. This last is a very remarkable total. South America having shipped no maize in December, 1911, figures are already complete, and verified at 586,000 qr. There were on December 30th 345,000 qr. of maize on passage to the United Kingdom, against totals of from 400,000 to 860,000 qr. at previous years' ends since the new century.

Oilseeds.—The United States are not only buying Canadian linseed, happily a good crop, but are entering the field as buyers of the new crop in La Plata. The latter is now put at 3,500,000 qr. available for exportation, which is considerably less than was estimated a month ago. India has added some 350,000 acres to her area under linseed, which should add as many quarters at least to the export surplus available from April. The prices ruling in linseed at the end of 1911 were 71*s.* per 410 lb. for Indian on spot, 67*s.* per 416 lb. for La Plata on spot, 62*s.* for February shipment of La Plata, and 61*s.* 9*d.* for May shipment of Indian. Speculation promises to be active for some months to come. There are only 46,000 qr. on passage. Cottonseed in December varied for fine Egyptian between 8*s.* 3*d.* and 8*s.* 9*d.* per cwt. It closed at the lower figure, and with 740,000 cwt. on passage.

Various.—Among prices asked for fair average quality samples on December 30th, last trading day of 1911, the following may be mentioned:—English good new crop beans, 40*s.* per 532 lb.; new dun peas, 33*s.* per 504 lb.; Indian chick peas, 29*s.* per 504 lb.; Burmese dari, 28*s.* per 480 lb.; Essex rye, 32*s.* per 480 lb.; good Russian buckwheat, 28*s.* per 416 lb.; Midlothian oatmeal, 40*s.* per 280 lb.; fine Canadian oatmeal, 27*s.* 6*d.* per 240 lb.; barley meal, 16*s.* per 240 lb.; maize meal, 16*s.* 9*d.* per 240 lb.; feeding rice, 9*s.* per cwt.; beet sugar, 15*s.* per cwt.; and soy bean oil, 29*s.* per cwt. A comparison of these prices with those which ruled on December 31st, 1910, discloses an almost general increase in the cost of foodstuffs.

THE LIVE AND DEAD MEAT TRADE IN DECEMBER.

A. T. MATTHEWS.

Fat Cattle.—The general quality of the cattle coming to market, of course, improved with the exhaustion of the supply of grass-feds, and the substitution of those fed in stall and yard, though many of these showed signs of haste in their disposal. Every feeder who had anything fairly good naturally kept it for Christmas, and the great markets associated with that season began about the 9th. At many of these annual events it was remarked that really first quality beasts were unusually scarce, and it would have been surprising had it been otherwise. A keen demand for the best existed everywhere, and even cattle classed as second quality made considerably more money, and helped to raise the averages for the month. These were as follows:—Shorthorns, 8*s.* 8¾*d.*, 7*s.* 8¾*d.*, and 6*s.* 5¼*d.*, against 8*s.* 5*d.*, 7*s.* 5*d.*, and 6*s.* 3*d.* in November; Herefords, 8*s.* 9¼*d.* and 8*s.* 0¾*d.*, against 8*s.* 7½*d.* and 7*s.* 8*d.*; Devons, 8*s.* 11¼*d.* and 7*s.* 10¾*d.*, against 8*s.* 7½*d.* and 7*s.* 7½*d.*; Welsh Runts, 8*s.* 6¼*d.* and 7*s.* 9*d.*, against 8*s.* 3*d.* and 7*s.* 6*d.*; and Polled Scots, 8*s.* 11*d.* and 8*s.* 2¾*d.*, against 8*s.* 7*d.* and 7*s.* 9¼*d.* per 14 lb. stone. Great credit is due to feeders of Devons for the splendid condition of a large proportion of the cattle of that breed in spite of the unfavourable season. In the week of Christmas sales and markets ending the 14th, the Devon average was the highest of all, not even excepting that of the Polled Scots. The Islington Great Market, held on the 11th, was well supplied, and prices exceeded, as a rule, those of last year by about ¼*d.* per lb.

Veal Calves.—There is only a small demand for veal at this season, and supplies, though greatly diminished as regards choice quality, were quite ample. The averages for the month were 8¼*d.* and 7¼*d.* per lb. for first and second quality.

Fat Sheep.—The very low price of fat and store sheep has been one of the worst features of the farming year, but it is generally recognised that, at least for the last few months, it has been caused, not by abnormal numbers in the country, or any decline in the ordinary demand, but by the exigencies of the season and the difficulties of farmers as regards "keep." The general condition of the sheep which have been offered to the butcher has been bad, and this drawback was aggravated as the season advanced. This told heavily against the price of sheep through the decrease thereby entailed on the value of the "fifth quarter." The low prices of November were indeed rather more than maintained, but this was partly owing to the growth of the fleece, natural to the season, and the firm trade in skins. Downs averaged in the English markets a fraction over 7¾*d.* per lb., but not quite 8*d.* for first quality, against a bare 7¾*d.* in November. Second quality averaged 7*d.*, against 6¾*d.*, and third 5½*d.*, against 5¼*d.* The Longwools did quite as well relatively, their averages being 7½*d.*, 6½*d.*, and 5*d.*, against 7¼*d.*, 6¼*d.*, and 5*d.* per lb. It will thus be seen that the small fluctuations which have occurred have been in sellers' favour, pointing to a growing scarcity of sheep in marketable condition.

Fat Pigs.—Bacon pigs have declined very slowly, but surely, for many months, and at present there is no sign of the end of this depression. Averages in December were 6*s.* 1¼*d.* per 14 lb. for prime small, and 5*s.* 6½*d.* for the heavier weights.

Carcass Beef—British.—The movements in values in the Central London Market are fairly typical of those of the whole country, and prices of native beef were very firm in December. Scotch short sides averaged 7*d.* to 7¼*d.*, according to quality, and long sides 6⅝*d.* to 6¾*d.* per lb., which was a shade higher than in November. English sides have been better supplied than for some months, and averaged 6*d.* to 6½*d.* per lb. There were no fancy or extra Christmas prices, but a good steady demand and ready clearance.

Port-Killed Beef.—The supplies of Deptford-killed sides have been extremely moderate, and this article meets with plenty of competition. Prices therefore have ruled strong, and the month's average is relatively high at 6*d.* to 6⅝*d.* per lb.

Chilled Beef.—United States chilled quarters have been scarcely discoverable on the London market, and quotations were nil. Argentine hindquarters ranged up to 3*s.* 6*d.* per 8 lb., the averages being 3*s.* 3¼*d.* and 2*s.* 11¼*d.* for first and second quality respectively. Forequarters also sold better, and averaged 2*s.* 1½*d.* and 1*s.* 11*d.* Both these quotations are much higher than those of November.

Frozen Beef.—"Hard" beef has been dealt in steadily, though the volume of business was limited. Prices were slightly higher, and averaged 2*s.* 3¼*d.* to 2*s.* 5½*d.* per 8 lb. stone for hinds, and 1*s.* 8¾*d.* to 1*s.* 10½*d.* for forequarters.

Carcass Mutton—Fresh-Killed.—Until the last week the trade in Scotch, English, and Dutch mutton was much depressed, owing to the

large supplies of the first-named. After Christmas the very small arrivals from the north caused a sharp advance of $\frac{3}{4}d.$ per lb. Scotch averaged $7d.$ and $6\frac{1}{2}d.$ for first and second quality, English $6\frac{1}{8}d.$ and $5\frac{5}{8}d.$, and Dutch $6d.$ and $5\frac{3}{8}d.$ per lb.

Frozen Mutton and Lamb.—The best New Zealand mutton averaged $4\frac{1}{2}d.$ and $4d.$ per lb.; Australian, $3\frac{1}{2}d.$; and Argentine $3\frac{1}{2}d.$ to $3\frac{3}{4}d.$ per lb. Frozen lamb was firm for the time of year, and its averages (for New Zealand) of $5\frac{1}{2}d.$ and $5\frac{1}{8}d.$ per lb. were slightly above those of November. Australian new season lamb fetched $4\frac{1}{2}d.$ to $5d.$ per lb.

Veal.—British veal of first and second quality averaged in London $7\frac{5}{8}d.$ and $6\frac{3}{4}d.$ per lb., but there were lower qualities on offer which did not approach these in price.

Pork.—The weather was rather too mild and damp for the trade, but, nevertheless, prices improved during the last two weeks, when $7d.$ per lb. was touched at Smithfield for prime small English. The month's averages were $6\frac{3}{8}d.$ and $5\frac{7}{8}d.$ for first and second quality. Dutch sold at slightly lower prices.

THE PROVISION TRADE IN DECEMBER.

HEDLEY STEVENS.

Although the year 1911 was a trying one for dealers, especially during the three months of abnormally hot weather, on the whole business has not been so trying and unprofitable as during the year 1910. Hog products have been more plentiful and cheaper than for the past two years, with freer arrivals from most countries, especially from the United States of America and Denmark. As a result of the high prices of feeding stuffs, English pigs have been marketed very freely during the latter part of the year, which will mean higher prices for the raw material, and dearer bacon during 1912, the same conditions having existed in other countries. The hot weather during the principal months for manufacturing cheese and butter caused a large shrinkage in the home make, and prices for both these commodities are expected to range exceptionally high before the next season commences.

Bacon.—The consumptive demand was disappointing for the month, considering the low prices prevailing, most descriptions being procurable at under November's low prices. The special features were the continued free offerings and comparatively low prices of long sides. In one week in the month the killings in Denmark created a record for that country, being 55,200 pigs.

Arrivals from America and Canada were in excess of requirements, and in consequence prices have favoured buyers. The demand for hams for the Christmas trade was unusually small. Dealers report that in December, 1910, when prices ranged from $17s.$ to $20s.$ per cwt. higher, their sales were considerably larger.

The consumptive demand in America for December is reported less, and in consequence packers have been able to accumulate a little stock in their cellars, and prices are slightly in buyers' favour. During December very little contracting for forward shipment was effected, as packers look for dearer hogs early in the spring, and importers refuse to pay the prices demanded. The values of hogs in

Chicago during the month ranged from $5.50 to $6.50, against $7.15 to $8.00 during the same period of 1910, and $7.80 to $8.70 two years back. English pigs were not marketed quite so freely, and in some districts higher prices were realised.

Cheese.—The demand has been moderate throughout the month with a continued tendency for higher prices on account of the small stocks available at all points, the month's advance being 1*s.* to 2*s.* on Canadians, or about 13*s.* to 16*s.* per cwt. over prices current at the same time in 1910. At the end of the month cable advices from Canada confirmed the reports as to the small stocks on hand in that country, and ask from 72*s.* 6*d.* to 74*s.* c.i.f. for prompt shipment. At the same period of 1910 purchases could be made at around 56*s.* to 57*s.* c.i.f. The shipments from May 1st to December 20th from Montreal, Quebec, Portland, and St. John's, show a decrease over 1910 of 92,435 cheese. At the end of the month the estimated stocks of Canadian cheese at the principal distributing centres (London, Liverpool, and Bristol), were 262,000 cheese, against 404,000 at the same time in 1910, and 377,000 two years ago. In the United States cheese are above an export basis, and extreme prices are anticipated during the winter.

Fair quantities of New Zealand cheese are arriving by each steamer, and selling at from 2*s.* to 3*s.* per cwt. under Canadians. Cable advices from that Colony report dry weather, which will doubtless reduce the make, but up to the end of December the shipments from the commencement of this season show a decrease.

There has been a good demand for English cheese, and really best lots realised high prices, in some cases 20*s.* to 22*s.* per cwt. over prices current at the same time in 1910.

Butter.—During the greater part of the month the demand was slow, and prices showed little change. By the end of the month the market was considerably influenced by the operations of speculators on the London market, and prices advanced, more especially for all descriptions of Colonial. Stocks are smaller at all points than usual at this time of year, and it is confidently expected that extremely high prices will be experienced during the winter. The shipments from New Zealand since the opening of the season to the end of December show a shortage of 1,940 tons compared with last year, but those from Australia show a slight increase. Spot prices at the end of the month ranged from 22*s.* to 26*s.* per cwt. over last year, and are considered by many to be dangerously high for so early in the season. Canada has sent us this season an increased quantity of over 107,000 packages over last year, but these have been mostly consumed. She is now short of butter for her home trade, and western points will have to import from New Zealand and Australia to supply their demand before the new season's Canadian can be placed on the market. The United States of America is also short of butter, the American Warehousemen's Association figures showing a shortage of nearly 26 million pounds on December 1st against the same date of 1910. This includes thirty-eight of the principal storage depots.

Eggs.—There has been a continued shortage of new laid eggs, and prices remain high. The mild weather has curtailed the consumption.

PRICES OF AGRICULTURAL PRODUCE.

AVERAGE PRICES of LIVE STOCK in ENGLAND and SCOTLAND in the Month of December, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	England. First Quality.	England. Second Quality.	Scotland. First Quality.	Scotland. Second Quality.
FAT STOCK:—	per stone.*	per stone.*	per cwt.†	per cwt.†
Cattle:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	8 11	8 5	41 11	38 0
Herefords	8 10	8 0	—	—
Shorthorns	8 9	7 9	40 7	37 3
Devons	9 0	8 0	—	—
	per lb.*	per lb.*	per lb.*	per lb.*
	d.	*d.*	*d.*	*d.*
Veal Calves	8¼	7¼	8½	7¼
Sheep:—				
Downs	8	7	—	—
Longwools	7½	6½	—	—
Cheviots	8¼	7½	8	6¾
Blackfaced	7¾	6¾	7¾	6½
Cross-breds	7¾	7	8¼	7¼
	per stone.*	per stone.*	per stone.*	per stone.*
Pigs:—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	6 2	5 8	5 10	5 3
Porkers	7 0	6 5	6 5	5 9
LEAN STOCK:—	per head.	per head.	per head.	per head.
Milking Cows:—	£ *s.*	£ *s.*	£ *s.*	£ *s.*
Shorthorns—In Milk ...	22 8	18 7	24 0	18 19
,, —Calvers... ...	22 14	17 2	20 15	17 6
Other Breeds—In Milk ...	17 14	16 6	20 3	16 5
,, —Calvers ...	12 10	11 15	19 13	16 3
Calves for Rearing	2 0	1 11	2 12	1 16
Store Cattle:—				
Shorthorns—Yearlings ...	9 3	7 14	10 17	8 15
,, —Two-year-olds...	12 18	11 8	14 5	11 15
,, —Three-year-olds	16 15	15 1	14 10	13 0
Polled Scots—Two-year-olds	—	—	16 6	13 14
Herefords— ,,	14 5	12 19	—	—
Devons— ,,	13 11	11 5	—	—
Store Sheep:—				
Hoggs, Hoggets, Tegs, and Lambs—	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Downs or Longwools ...	30 7	24 6	—	—
Scotch Cross-breds ...	—	—	29 1	23 3
Store Pigs:—				
8 to 10 weeks old	12 10	9 2	15 5	11 7
12 to 16 weeks old	22 6	16 1	—	—

* Estimated carcass weight.

† Live weight.

AVERAGE PRICES of DEAD MEAT at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Quality.	Birmingham.	Liverpool.	London.	Manchester.	Edinburgh.	Glasgow.
		per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
BEEF :—							
English	1st	57 6	55 0	60 0	55 0	59 6*	60 0*
	2nd	51 6	50 0	56 0	50 0	52 6*	53 6*
Cow and Bull ...	1st	49 0	44 6	46 6	46 6	46 6	48 0
	2nd	41 6	39 6	42 0	42 0	38 0	41 6
U.S.A. and Canadian :—							
Port Killed ...	1st	—	55 0	59 6	—	—	—
	2nd	—	51 6	55 6	—	—	—
Argentine Frozen—							
Hind Quarters...	1st	34 6	35 0	34 6	35 0	34 6	35 6
Fore ,, ...	1st	25 6	25 6	26 0	25 6	24 6	25 6
Argentine Chilled—							
Hind Quarters...	1st	44 6	39 0	46 0	39 6	44 0	43 6
Fore ,, ...	1st	27 6	25 6	29 6	26 0	29 6	30 6
Australian Frozen—							
Hind Quarters...	1st	33 0	32 6	34 6	33 0	—	32 6
Fore ,, ...	1st	25 6	23 6	26 0	23 6	—	23 6
VEAL :—							
British	1st	60 6	72 6	71 0	72 0	—	69 0
	2nd	56 0	66 6	63 0	66 6	—	65 6
Foreign	1st	—	—	71 0	—	—	—
MUTTON :—							
Scotch	1st	—	67 0	65 6	67 0	58 6	67 6
	2nd	44 6	60 6	60 6	62 6	52 0	49 0
English	1st	59 0	60 6	57 0	62 6	—	—
	2nd	56 0	56 0	53 0	59 0	—	—
Argentine Frozen ...	1st	35 6	36 0	35 6	36 0	34 0	34 6
Australian ,, ...	1st	34 6	34 0	32 6	34 0	—	33 6
New Zealand ,, ...	1st	—	—	41 6	—	—	—
LAMB :—							
British	1st	—	—	—	—	—	—
	2nd	—	—	—	—	—	—
New Zealand ...	1st	53 0	48 6	51 6	48 6	—	—
Australian	1st	47 0	41 6	45 0	41 6	—	39 6
Argentine	1st	44 6	42 0	45 0	42 0	—	39 6
PORK :—							
British	1st	61 0	56 6	59 6	60 0	55 6	55 0
	2nd	57 6	51 6	55 0	54 0	46 6	49 6
Foreign	1st	—	—	55 6	—	—	—

* Scotch.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each Week in 1909, 1910 and 1911.

Weeks ended (*in* 1911).	WHEAT.						BARLEY.						OATS.					
	1909.		1910.		1911.		1909.		1910.		1911.		1909.		1910.		1911.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 7 ...	32	9	33	6	30	5	26	11	24	11	23	11	17	5	17	2	17	0
,, 14 ...	32	8	33	8	30	8	27	1	24	11	23	10	17	5	17	7	17	2
,, 21 ...	33	2	33	9	30	11	27	3	24	11	24	4	17	8	17	6	17	4
,, 28 ...	33	0	33	6	30	11	27	6	25	0	24	5	17	9	17	4	17	3
Feb. 4 ...	33	4	33	7	30	9	27	7	24	10	24	5	17	10	17	7	17	5
,, 11 ...	33	8	33	4	30	5	27	8	24	9	24	6	17	11	17	11	17	5
,, 18 ...	34	1	33	0	30	3	27	11	24	6	24	7	18	0	18	0	17	6
,, 25 ...	34	5	32	7	30	2	28	0	24	2	24	9	18	0	17	10	17	7
Mar. 4 ...	34	10	32	7	30	0	27	11	24	6	25	0	18	2	18	1	17	5
,, 11 ...	35	8	32	6	30	1	28	4	24	1	25	0	18	2	18	0	17	5
,, 18 ...	35	9	32	6	30	1	28	0	23	6	24	11	18	5	18	0	17	6
,, 25 ...	36	0	32	9	30	2	28	0	23	7	25	0	18	6	17	11	17	5
Apl. 1 ...	36	5	33	0	30	3	27	10	23	8	24	11	18	8	18	0	17	5
,, 8 ...	37	4	33	6	30	4	28	0	23	1	24	7	18	10	17	11	17	7
,, 15 ...	38	7	33	7	30	3	27	8	23	5	25	2	19	2	18	3	18	3
,, 22 ...	41	4	33	7	30	4	28	2	23	0	25	5	19	9	18	3	17	10
,, 29 ...	42	5	33	0	30	11	27	10	22	10	25	5	20	0	18	3	18	3
May 6 ...	40	9	32	6	31	4	27	7	22	7	25	7	20	3	18	2	18	6
,, 13 ...	41	6	32	1	31	8	27	3	22	0	25	1	20	6	18	1	19	0
,, 20 ...	42	8	31	10	32	6	27	0	21	8	25	4	20	11	17	8	19	2
,, 27 ...	42	6	31	3	32	8	26	3	21	4	25	0	21	0	17	10	19	5
June 3 ...	43	1	30	2	32	5	25	7	21	8	24	10	21	3	17	10	19	5
,, 10 ...	42	11	29	1	32	4	26	10	20	9	25	7	21	4	17	10	19	7
,, 17 ...	42	7	29	0	32	3	26	10	18	11	23	11	21	6	18	0	19	8
,, 24 ...	42	8	29	4	31	11	27	2	20	1	23	9	21	7	17	9	19	10
July 1 ...	42	9	29	9	31	10	27	2	19	11	24	5	21	9	17	7	19	9
,, 8 ...	43	0	30	4	32	1	26	4	19	5	25	10	21	8	17	4	19	9
,, 15 ...	43	3	31	1	32	3	26	10	21	3	25	10	21	9	17	7	19	11
,, 22 ...	44	0	31	11	32	5	27	4	19	9	24	3	22	5	17	5	19	5
,, 29 ...	43	5	33	5	32	5	24	6	20	10	23	8	22	2	18	1	19	7
Aug. 5 ...	44	9	33	9	32	0	27	4	20	5	24	4	22	11	18	3	18	2
,, 12 ...	44	9	33	5	31	6	24	9	20	4	26	9	21	8	18	0	18	0
,, 19 ...	41	6	32	11	31	6	23	11	20	11	27	8	19	8	17	11	17	10
,, 26 ...	38	5	32	7	31	8	24	7	20	10	28	10	19	4	17	2	18	0
Sept. 2 ...	37	2	32	2	31	7	26	3	22	10	28	4	19	6	17	2	18	3
,, 9 ...	34	11	31	11	31	10	26	1	23	3	28	4	18	5	17	2	18	1
,, 16 ...	33	6	30	11	32	0	26	5	24	3	29	0	17	9	16	6	18	5
,, 23 ...	32	9	30	2	32	4	26	8	24	2	29	11	17	7	16	3	18	9
,, 30 ...	32	2	30	1	32	6	26	9	24	4	30	5	17	2	16	4	19	1
Oct. 7 ...	31	8	30	1	32	7	26	9	24	7	30	9	17	0	16	3	19	5
,, 14 ...	31	4	30	2	32	9	27	0	25	1	31	0	17	0	16	2	19	10
,, 21 ...	31	8	30	4	32	9	27	7	25	3	31	5	16	11	16	1	19	11
,, 28 ...	31	10	30	4	33	1	27	9	25	4	31	7	17	0	16	2	20	6
Nov. 4 ...	32	5	30	4	33	4	27	9	25	6	31	10	17	0	16	2	20	8
,, 11 ...	32	5	29	11	33	4	27	7	25	4	32	7	17	1	15	11	20	11
,, 18 ...	32	7	29	8	33	1	27	0	25	1	32	10	17	4	16	1	21	0
,, 25 ...	33	0	29	11	33	0	26	8	24	10	33	5	17	3	16	4	20	10
Dec. 2 ...	33	3	30	6	32	10	26	1	24	7	33	10	17	4	16	7	20	11
,, 9 ...	33	3	30	9	32	9	25	7	24	3	34	0	17	3	16	9	20	9
,, 16 ...	33	2	30	7	32	11	25	3	23	9	33	5	17	4	16	10	20	9
,, 23 ...	33	1	30	7	32	9	25	2	23	10	33	5	17	4	16	9	20	8
,, 30 ...	33	3	30	5	33	0	25	1	23	9	33	4	17	4	16	9	20	7

NOTE.—Returns of purchases by weight or weighed measure are converted to Imperial Bushels at the following rates: Wheat, 60 lb.; Barley, 50 lb.; Oats, 39 lb. per Imperial Bushel.

AVERAGE PRICES of **Wheat, Barley,** and **Oats** per Imperial Quarter in FRANCE, BELGIUM, and GERMANY, and at PARIS, BERLIN, and BRESLAU.

		Wheat.				Barley.				Oats.			
		1910.		1911.		1910.		1911.		1910.		1911.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
France :	November	46	2	43	3	25	8	27	11	21	0	22	2
	December	46	7	43	4	25	10	28	2	21	3	22	4
Paris :	November	48	1	43	9	26	0	27	3	21	3	22	11
	December	48	5	44	2	26	2	27	7	21	8	23	2
Belgium :	October	33	7	34	1	22	6	27	7	18	11	22	4
	November	32	3	33	10	22	6	27	11	19	7	22	9
Germany :	October	40	11	43	3	26	8	34	4	20	9	25	0
	November	40	6	42	9	27	11	35	1	20	10	25	0
Berlin :	October	43	1	43	10	—		—		20	3	25	7
	November	43	0	43	7	—		—		20	6	25	2
Breslau :	October	38	5	40	4	25 9* / 22 11†		30 10* / 25 1†		20	7	23	7
	November	37	9	39	9	26 6* / 22 11†		32 6* / 27 7†		19	9	23	6

* Brewing. † Other.

NOTE.—The prices of grain in France have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique* ; the Belgian quotations are the official monthly averages published in the *Moniteur Belge* ; the German quotations are taken from the *Deutscher Reichsanzeiger*, the prices for the German Empire representing the average of the prices at a number of markets.

AVERAGE PRICES of **British Wheat, Barley,** and **Oats** at certain Markets during the Month of December, 1910 and 1911.

	Wheat.				Barley.				Oats.			
	1910.		1911.		1910.		1911.		1910.		1911.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
London...	31	4	34	0	23	1	31	10	18	5	22	2
Norwich	30	8	32	7	23	6	33	7	16	11	21	3
Peterborough	30	1	32	4	23	7	32	1	16	6	20	11
Lincoln...	30	4	32	10	23	6	33	5	16	6	20	7
Doncaster	30	4	32	10	23	4	33	5	16	5	20	5
Salisbury	30	1	32	1	22	1	33	1	16	3	20	4

CORN PRICES:—ANNUAL AVERAGES.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Weekly Averages of Corn Returns from the Returning Markets, together with the QUANTITIES returned as sold at such Markets during each of the Years 1905 to 1911.

YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. d.	*s. d.*	*s. d.*	Quarters.	Quarters.	Quarters.
1905... ..	29 8	24 4	17 4	2,467,551	3,265,613	1,073,611
1906... ...	28 3	24 2	18 4	2,684,101	3,210,995	1,011,931
1907... ...	30 7	25 1	18 10	2,722,847	3,317,521	1,374,260
1908... ...	32 0	25 10	17 10	3,293,506	3,293,916	1,304,223
1909... ...	36 11	26 10	18 11	2,641,225	2,699,628	905,983
1910... ...	31 8	23 1	17 4	3,072,523	3,205,203	791,121
1911... ...	31 8	27 3	18 10	3,140,257	3,123,986	858,341

AVERAGE VALUE per IMPERIAL QUARTER OF WHEAT IMPORTED into the UNITED KINGDOM from the undermentioned Foreign Countries and British Possessions in the years 1909, 1910, and 1911.

Countries from which consigned.	Average Value per Imperial Quarter.		
	1909.	1910.	1911.
	s. d.	*s. d.*	*s. d.*
Argentine Republic	39 9	34 11	33 4
Chile	39 1	33 7	33 0
Germany	38 3	36 11	33 6
Bulgaria	—	33 0	—
Roumania	40 9	34 2	34 7
Russia	39 3	35 7	33 4
Turkey	32 4	30 0	27 3
U.S. of America	38 6	37 3	34 9
British East Indies	40 8	35 5	33 7
Canada	39 3	36 9	34 10
Australia	41 5	37 2	34 10
New Zealand	40 6	32 7	32 11

AVERAGE PRICES of PROVISIONS, POTATOES, and HAY at certain MARKETS in ENGLAND and SCOTLAND in the Month of December, 1911.

(Compiled from Reports received from the Board's Market Reporters.)

Description.	Bristol.		Liverpool.		London.		Glasgow.	
	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.	First Quality.	Second Quality.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
BUTTER :—	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.	per 12 lb.
British ...	16 0	15 0	—	—	18 0	16 0	16 0	—
	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Irish Creamery	134 0	126 0	131 0	128 0	—	—	—	—
,, Factory	122 0	110 0	121 0	117 0	—	—	—	—
Danish ...	—	—	138 0	135 6	139 0	136 6	135 0	—
French ...	—	—	—	—	145 6	141 6	—	—
Russian ...	124 0	120 0	125 0	121 6	126 6	122 6	122 0	—
Canadian ...	129 6	125 6	125 0	122 0	—	—	—	—
Australian ...	131 6	128 0	130 0	127 0	128 0	125 6	129 0	126 0
New Zealand	134 6	132 0	133 0	131 0	133 6	129 6	133 0	132 0
Argentine ...	130 0	128 0	129 6	127 6	127 6	125 0	130 0	—
CHEESE :—								
British—								
Cheddar ...	89 0	84 0	88 0	84 0	95 0	86 0	76 0	74 0
			120 lb.	120 lb.	120 lb.	120 lb.	120 lb.	120 lb.
Cheshire ...	—	—	87 0	81 0	94 6	86 0	—	—
			per cwt.	per cwt.	per cwt.	per cwt.	per cwt.	per cwt.
Canadian ...	71 0	69 6	71 0	69 0	71 6	70 0	70 0	—
BACON :—								
Irish	57 6	54 0	55 0	51 6	59 0	56 6	55 6	—
Canadian ...	51 6	49 0	50 0	47 0	52 0	48 0	51 0	49 0
HAMS :—								
Cumberland ...	—	—	—	—	111 6	103 0	—	—
Irish	—	—	—	—	118 0	107 0	78 0	74 0
American (long cut)	58 0	54 6	56 0	52 0	61 6	57 6	54 0	—
EGGS :—	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.	per 120.
British ...	20 0	18 4	—	—	20 5	—	—	—
Irish	18 5	17 7	16 6	15 6	17 0	16 0	17 4	15 10
Danish ...	—	—	16 3	15 3	18 0	16 4	17 1	16 7
POTATOES :—	per ton.	per ton.	per ton.	per ton.	per ton	per ton.	per ton.	per ton.
Edward VII.	90 0	80 0	63 6	58 6	78 6	72 6	—	—
Langworthy ...	85 0	80 0	81 6	75 0	96 0	88 6	—	—
Up-to-Date ...	80 0	72 6	55 0	51 6	82 6	75 0	58 6	53 6
HAY :—								
Clover ...	110 0	100 0	120 0	95 0	122 0	100 0	86 0	81 0
Meadow ...	105 0	95 0	—	—	116 6	94 6	—	—

DISEASES OF ANIMALS ACTS, 1894 to 1911.

NUMBER OF OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	DECEMBER.		TWELVE MONTHS† ENDED DECEMBER.	
	1911.	1910.	1911.	1910.
Swine-Fever:—				
Outbreaks	234	238	2,466	1,598
Swine Slaughtered as diseased or exposed to infection ...	3,404	2,919	30,434	15,543
Anthrax:—				
Outbreaks*	99	178	908	1,496
Animals attacked	131	209	1,121	1,776
Foot-and-Mouth Disease:—				
Outbreaks	1	—	19	2
Animals attacked	20	—	487	15
Glanders (including Farcy):—				
Outbreaks	16	21	208	351
Animals attacked	38	58	501	1,014
Sheep-Scab:—				
Outbreaks	80	157	434	556

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	DECEMBER.		TWELVE MONTHS† ENDED DECEMBER.	
	1911.	1910.	1911.	1910.
Swine-Fever:—				
Outbreaks	32	19	175	105
Swine Slaughtered as diseased or exposed to infection ...	222	269	2,566	2,236
Anthrax:—				
Outbreaks	—	—	9	7
Animals attacked	—	1	16	13
Glanders (including Farcy):—				
Outbreaks	—	—	2	1
Animals attacked	—	—	3	2
Sheep-Scab:—				
Outbreaks	38	86	342	491

* For 1910 the figures show the outbreaks reported, but for 1911 the outbreaks confirmed.

† The twelve months comprise 53 weeks in 1910 and 52 weeks in 1911.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

U.S. Dept. of Agriculture, Office of the Secretary.—Circ. No. 38 :—Conservation of the Soil. (8 pp.) Washington, 1911. [B. 40–1.]

Royal Commission on Sewage Disposal.—Seventh Report. Vol. III.—Appendices.—Part II. :—Minutes of Evidence with regard to the Treatment of Trade Effluents. Reports by the Officers of the Commission upon the Preliminary Treatment of Sewage in Slate Beds. [Cd. 5543–1.] (215 pp.) London : Wyman & Sons, 1911. 1*s.* 9*d.* [B. 24–7.]

Sociedad Rural Argentina.—Argentina, its Agriculture and Live Stock in 1910. (176 pp. and map.) Buenos Aires, 1911. [A. 82 ; F. 52.]

U.S. Dept. of Agriculture, Office of Experiment Stations.—Bull. No. 240 :—Tidal Marshes and their Reclamation. (99 pp. + xvi. plates and 6 maps.) Washington, 1911. [B. 56.]

Institut International d'Agriculture.—Assemblée Générale, Troisième Session, May, 1911. Procès Verbaux. (640 pp.) Rome, 1911.

[This volume also contains reports presented to the Assembly by Delegates to the Permanent Committee, *e.g.*, a Report by Dr. Mueller on the Agricultural Statistical Service ; a Report by Professor Cuboni on Plant Diseases ; and a Report by M. de Miklos on the Campbell System of "Dry Farming."]

Field Crops—

Memoirs of the Dept. of Agriculture, India, Botanical Series.—Vol. IV., No. 2 :—Studies in Indian Fibre Plants. No. 2. On Some New Varieties of *Hibiscus Cannabinus*, L., and *Hibiscus Sabdariffa*, L. (36 pp. + 7 plates.) Calcutta, 1911. Rs. 3. [C. 48.]

California Agricultural Experiment Station.—Bull. No. 212 :—California White Wheats [including milling and baking tests]. (313–394 pp.) Berkeley, California, 1911. [C. 2–1.]

Ohio Agricultural Experiment Station.—Bull. No. 231 :—Wheat Experiments. (22 pp.) Wooster, Ohio, 1911. [C. 2–1.]

Deutsche Landwirtschafts-Gesellschaft.—Arbeiten. Heft 194 :—Hafer im Bilde. (17 pp. + 16 plates.) Berlin : Paul Parey, 1911. [C. 16.] 2 M.

Hawaii Agricultural Experiment Station.—Bull. No. 23 :—Leguminous Crops in Hawaii. (30 pp. + 8 plates.) Washington, 1911. [C. 44–1.]

Braham, Frank.—The Rubber-Planter's Note Book. (108 pp.) London : Crosby, Lockwood & Son, 1911. 2*s.* 6*d.* net. [C. 58–3.]

Colonial Office.—Return showing the Places throughout the Empire where Tobacco is cultivated and the Extent of the Industry, and whether in any of the Overseas Dominions there is any Excise or Export Duty on the Home-Grown Tobacco, and if so, the Amount. (H. C. 303, 1911.) (7 pp.) London : Wyman & Sons, 1911. 1*d.* [C. 54.]

Palmer, Truman G.—Letter and Data Concerning the Indirect Agricultural Benefits which are Derived from the Culture of Sugar Beets. [U.S. Senate Document No. 76.] (22 pp.) Washington, 1911. [C. 34–3.]

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Foreign Office.—Interim Report of the British Delegate to the International Sugar Commission, together with his instructions, October, 1911. [Cd. 5859.] In continuation of Cd. 5557, 1911. (2 pp.) London : Wyman & Sons, 1911. 1*d.* [C. 34–7.]

University College, Reading.—Bull. No. X. :—Manuring of Swedes. Trials

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U.S. Dept. of Agriculture, Bureau of Statistics.—Bull. No. 84 :—Russian Cereal Crops. Area and Production by Governments and Provinces. (99 pp. and map.) [C. 2–3.] Bull. No. 89 :—Marketing Grain and Live Stock in the Pacific Coast Region. (94 pp.) [C. 2–3 ; F. 46.] Washington, 1911.

Kansas Agricultural Experiment Station.—Bull. No. 177 :—Milling Tests of Wheat and Baking Tests of Flour. (28–153 pp.) Manhattan, Kansas, 1911. [C. 6.]

Nebraska Agricultural Experiment Station.—Press Bull. No. 35 :—Catch Crops for Hay and Pasture. (3 pp.) Lincoln, Nebraska, 1911. [C. 44–1.]

United Provinces of Agra and Oudh, Dept. of Land Records and Agriculture.—Bull. No. 26 :—Description of the Working Sugar Factory exhibited in the Agricultural Court, United Provinces Exhibition, by Messrs. Blair, Campbell, and McLean. (15 pp.) Allahabad, 1911. [C. 34–11 ; M. 4.]

California Agricultural Experiment Station.—Bull. No. 216 :—A Progress Report upon Soil and Climatic Factors Influencing the Composition of Wheat. (547–574 pp.) Sacramento, 1911. [C. 2–1.]

Horticulture—

Thompson, J. Enoch.—The Intensive Cultivation of Small Farms. (15 pp.) Toronto : W. Briggs, 1911. 10 cents. [D. 16–7.]

Guide to Mr. Worthington Smith's Drawings of Field and Cultivated Mushrooms and Poisonous or Worthless Fungi often Mistaken for Mushrooms. (24 pp. and plates.) London : British Museum, 1910. 1*s.* [D. 44 ; E. 60–3.]

Weathers, J.—The Bulb Book, or Bulbous and Tuberous Plants for the Open Air, Stove, and Greenhouse. (471 pp.) London : John Murray, 1911. 15*s.* net. [D. 26–5.]

Canada, Dept. of Agriculture, Dairy and Cold Storage Branch.—Bull. No. 27 :—Trial Shipments of Peaches in 1910. (35 pp.) Ottawa, 1911. [D. 34.] [Information as to temperature during transit, method of packing, prices obtained, &c.]

New Hampshire Agricultural Experiment Station.—Bull. No. 153 :—Fruit Bud Formation. Progress of Investigations in 1908, 1909, 1910. (38 pp.) Durham, N.H., 1911. [D. 30.] [This bulletin deals with apples only.]

California Agricultural Experiment Station.—Bull. No. 213 :—The Principles of Wine-making. (391–442 pp.) Berkeley, California, 1911. [D. 48.]

New York Agricultural Experiment Station.—Bull. No. 339 :—Is it Necessary to Fertilise an Apple Orchard? (151–195 pp.) Geneva, New York, 1911. [D. 30.]

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Smith, T.—The Profitable Culture of Vegetables : For Market Gardeners, Small Holders, and others. (452 pp.) London : Longmans, Green & Co., 1911. 6*s.* net. [D. 18.]

Plant Diseases—

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Virginia Agricultural Experiment Station.—Bull. No. 192 :—Tomato Blight and Rot in Virginia. (16 pp.) Blacksburg, Virginia, 1911. [E. 60–7.]

Pennsylvania Agricultural Experiment Station.—Bull. No. 110 :—The Control of Insects and Diseases Affecting Horticultural Crops. (44 pp.) Centre County, Pennsylvania, 1911. [E. 20–3.]

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New York Agricultural Experiment Station.—Technical Bull. No. 18 :—A Contribution to the Life-History, Parasitism, and Biology of *Botryosphæria Ribis.* (109–190 pp.) Geneva, New York, 1911. [E. 60–11.]

Ohio Agricultural Experiment Station.—Bull. No. 228 :—Two Recent Important Cabbage Diseases of Ohio. ["Wilt," "Fusarium Wilt" or "Yellows," and "Black-leg," "Foot-rot" or "Phoma Wilt."] (251–297 pp.) [E. 60–7.] Bull. No. 229 :—The Fusarium Blight (Wilt) and Dry Rot of the Potato. Preliminary Studies and Field Experiments. (297–337 pp.) [E. 60–37.] Wooster, Ohio. 1911.

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Report on Cattle-Feeding Experiments with Soya-Bean Cake. (16 pp.) Edinburgh, 1911. [F. 68–1.]

Local Government Board, Reports on Public Health and Medical Subjects.—No. 57 :—Report by Dr. Reginald Farrar on inquiries in China and Siberia respecting pork and bacon exported to England. (15 pp.) London : Wyman & Sons, 1911. 4*d.* [F. 34 ; F. 82.]

New Mexico Agricultural Experiment Station.—Bull. No. 79 :—Alfalfa and Corn for Fattening Lambs. (18 pp.) Santa Fé, New Mexico, 1911. [F. 76–1.]

Rhodesia, Dept. of Agriculture.—Leaflet No. 4 :—The Construction of Pig-Sties. (10 pp.) [F. 82 ; M. 2.] Leaflet No. 5 :—Bacon Curing on the Farm. (6 pp.) [F. 82–3.] Salisbury, Rhodesia, 1911.

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Royal Commission on Horse Breeding.—Fourteenth and Final Report. [Cd. 5936.] (9 pp.) London : Wyman & Sons, 1911. 1½*d.* [F. 64–1.]

Illinois Agricultural Experiment Station.—Circ. No. 153 :—Additional Facts in Swine Feeding with special reference to developing swine for breeding purposes. (4 pp.) [F. 82–1.] Bull. No. 150 :—Feeding Farm Work Horses. (431–461 pp.) [F. 64–3.] Urbana, Illinois, 1911.

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Wisconsin Agricultural Experiment Station.—Circ. of Information No. 28 :—Distribution of Licensed Stallions in the Counties of Wisconsin during 1911. (27 pp.) Madison, Wisconsin, 1911. [F. 46.]

Dairying and Food, General—

Thomson, G. Sutherland.—Milk and Cream Testing and Grading Dairy Products for School, Farm, and Factory. (204 pp.) London : Crosby, Lockwood & Son, 1911. 4*s.* 6*d.* net. [G. 56–3.]

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Veterinary Science—

Royal Commission on Tuberculosis (Human and Bovine).—Final Report. Part II. Appendix. Vol. IV. :—Investigations into the Tuberculosis occurring naturally in Certain Animals other than Man : and Modification Experiments. [Cd. 5894.] (451 pp.) London : Wyman & Sons, 1911. 4*s.* 5*d.* [H. 54–3.]

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Engineering—

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